ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.
Vol. XXXIV, No. 15.

TABLE OF CONTENTS.

ENGINEERING NEWS OF THE WEEK..... 233
Sixty-Inch Steel Conduit for the Water-Works of Allegheny, Pa. (illustrated)..... 234
The Popp-Conti Compressed Air Conduit System for Street Railways 235
Tests of Paving Brick at Newark, N. J..... 236
Prospects for a Deep Waterway from the Great Lakes to the Hudson..... 236
Bridge Type of Rail Joint; Duluth & Iron Range R. R. (illustrated)..... 238
The New U. S. Government Lock at Sault Ste. Marie, Mich. (with inset, illustrated)..... 238
Radial Truck for Street Cars (illustrated)..... 242
As Seen by an Engineer (Editorial Correspondence) 243
Cable Incline Railways of the World..... 245
A Protractor for Compound Curves (illustrated).. 246
Long-Distance Power Transmission by Electricity at Portland, Ore..... 247
EDITORIAL NOTES 240
A Monograph on the Chicago Drainage Canal—Water Power Development from the Drainage Canal Flow—Cable Incline Railways for Tourist Traffic—Civil Service Methods in Selecting American Consuls.
EDITORIAL.
A Deep Waterway from the Great Lakes to the Ocean 240
LETTERS TO THE EDITOR..... 241
Concerning Nicaragua Canal Routes—The Economic Depth of Plate Girders—Notes and Queries.

Legal steps have been taken by the town of Millbury, Mass., to compel the city of Worcester to remove all offensive and polluting matter from its sewage before discharging it into the Blackstone River. The Massachusetts legislature passed an act in 1886 requiring Worcester to construct a sewage purification plant within four years. Chemical precipitation works were put in operation in June, 1890, as described in Engineering News of Nov. 15 and 22, 1890, and July 28, 1892. This plant was too small to treat the full flow of sewage and surface drainage of the city, diluted as it is by the waters of a brook, and in 1893 an addition to the plant was built, as described at length in our issues of Jan. 11, 18 and March 8, 1894. Millbury is on the Blackstone River, below Worcester, and prior to the construction of the purification plant the river bed and banks had become so fouled with deposits of sewage matters, and the river itself was so badly polluted at low water, that Millbury and other towns below secured the legislation mentioned above. Since the works were put in operation, Millbury has complained from time to time that a proper degree of purification was not being effected, and now it asks the court for relief. The precipitation plant now has a rated capacity of 15,000,000 gallons a day; but a large part of the city has the combined system of sewerage, and prior to the construction of purification works Mill Brook, which drains quite a large area, had been converted into an outlet sewer. The dry weather flow of the combined sewers and brook is said to be from 11,000,000 to 15,000,000 gallons a day, or about the capacity of the plant. The separation of the sewage and brook waters has long been talked of, and should Millbury win its suit would probably be carried out as speedily as possible. Plans for this, we believe, have already been prepared by Mr. F. A. McClure, City Engineer, of Worcester. The works have been operated for a number of years under the efficient direction of Mr. H. P. Eddy, first as chemist in charge and later as superintendent of sewers.

The Chicago Subway Arcade and Traction Co. is seeking the permission of the city to build 14 miles of subways, described as follows: The plan is to excavate 16 ft. below the present street surface from house to house, and to cover over this space with an iron and concrete roof, supported on steel columns. All street railway traffic would then be operated in the subway, leaving the street proper for ordinary traffic. The plans show sidewalks and stores facing the subway; and the claim is made that this subway shall be well ventilated and brilliantly lighted, thus doubling the present shop frontage. No detail plans or estimates are yet made public, and as yet the project is purely in the promotion stage.

The steel cable for the Columbus Ave. Ry. in New York city weighs 144,700 lbs., or, with its spool, about 80 tons. It is claimed to be one of the largest single lengths of wire cable ever made.

The electric locomotive used to haul trains through the Baltimore belt tunnel of the Baltimore & Ohio R. R., is said to have pulled a train of 44 loaded cars and three steam locomotives on Oct. 6, the total weight of the train being nearly 1,900 tons.

A new storage battery of the Plante type is being introduced by the Standard Storage Battery Co., of New York. The battery plate in ordinary practice is of lead and its surface is made as great as possible by some cellular construction in order that it may contain the maximum amount of active material, which is introduced into the pores, or cells, in the plate by a mechanical process. In the "porous-Plante" battery the plate is made porous by the action of granulated pumicestone mixed with the lead when in a molten condition. The air in the pores of the pumicestone expands under the action of the heat, and the plate when cast is of such a spongy texture that a plate of ordinary size will absorb 5½ oz. of water. The plate is coated with active material by electrolytic action.

The heaving of railway tracks by frost is said to have been prevented on some of the Norwegian railways by spreading salt liberally on the ground, the good effects of this plan lasting for some years.

A fast run from Buffalo to New York, on the Delaware, Lackawanna & Western R. R., was made on Oct. 5 by a special train consisting of an engine, parlor car and day car. The total run of 407 miles was made in 452 minutes, including four stops to change engines. The time from Buffalo to Binghamton was 175 minutes for the 199 miles, with one stop; from Corning to Elmira, 16 miles in 11 minutes; from Elmira to Binghamton, 57 miles in 54 minutes; and from Washington to the Hoboken terminus, 67 miles in 66 minutes. The reports state that the distance of 6½ miles from Corning to Big Flats was made in 4 minutes, or at the rate of 99½ miles per hour.

A fast run on the Michigan Central R. R. was made Oct. 1 by a special train, run for Mr. J. Pierpont Morgan. The train, consisting of two sleeping cars and a baggage car, left Buffalo, N. Y., at 2:11 a. m., making the run of 123 miles to St. Thomas in 154 minutes, and 112 miles thence to Windsor in 106 minutes, the highest speed recorded being 72½ miles per hour. From Detroit to Chicago, 285 miles, the run was made in 351 minutes.

The abolition of grade-crossings at Newark, N. J., is under discussion. It is reported that the city, the Pennsylvania R. R. and the Central R. R. of New Jersey will each appoint an engineer, and these three engineers will investigate and report upon plans for raising the tracks. One great difficulty is the connection with important freight yards.

A grade-crossing commission has been appointed by the Supreme Court in answer to the petition of the mayor and aldermen of Boston, Mass., which commission will have power to accomplish the separation of grades in the city. The commissioners are Henry S. Milton, of Waltham; Henry G. Taft, of Uxbridge, and Edward E. Bishop, of Haverhill. The railways concerned are the Boston & Albany, Boston & Maine, Fitchburg, and New York, New Haven & Hartford.

Trains are being used to haul water to supply the Pennsylvania R. R. shops at Altoona, according to a press despatch. About 350,000 gallons a day, it is said, will be hauled from Hollidaysburg, about eight miles distant from the city water-works. This place is said to be the only town in the Juniata valley which has at present a plentiful water supply available.

The contract for putting in a concrete base at the foot of the inner slope of the leaky Queen Lane reservoir of the Philadelphia water-works has been awarded to the Pennsylvania Asphalt Paving Co. at 40 cts. per cu. yd. for excavation and $5.50 for concrete in place. This work is in accordance with the advice of the experts on repairs to the reservoir, whose report was abstracted at some length in our issue of Aug. 15, 1895.

The new mail cars on the Third Ave. cable road, New York city, are 28 ft. long over all, 20 ft. long over the body, 7 ft. 6 ins. wide, 7 ft. 8 ins. high inside, and 10 ft. 6 ins. from the rail to top of roof. Each is carried on four 33-in. wheels, with a wheelbase of 7 ft., and weighs about 9,400 lbs. They are hauled behind passenger cars, and carry two mail clerks on each trip. The interior is lighted by the Pintsch compressed gas system. The cars were built by the J. G. Brill Co., of Philadelphia, Pa., and cost about $1,100 each.

The most serious railway accident of the week was the derailment of a fast freight train on the Worcester Division of the New York, New Haven & Hartford R. R., at Blackstone Junction, R. I., Oct. 5. The switch leading to a turntable had been left open, and the train ran over the sidetrack and was wrecked in the turntable pit. The engineman and head brakeman were killed, and another trainman was fatally injured. The engine and nine cars were wrecked. It is said that the switch was electrically connected with a distant signal, but that the signals were temporarily out of service, owing to the work incidental to changing the running of trains from the left hand to the right-hand track, which change has only recently been instituted.

A head collision between a passenger and a freight train occurred Oct. 6 on the Belgian State Railway between Wavre and Ottignies. The lightly-built passenger cars were telescoped and smashed, and the reports state that 18 persons were killed and nearly a hundred injured, some fatally. The accident is attributed to the work of a new and incompetent man temporarily acting as signalman at Ottignies.

The boiler in engine house No. 3 of the Wharton iron mine at Hibernia, N. J., exploded Oct. 8, seriously injuring six men.——One boiler in a battery of three at the A. J. Howell & Sons' factory, Westchester, N. Y., exploded Oct. 6, killing the engineman. The boiler was a horizontal, externally-fired boiler, 5 ft. in diameter and 16 ft. long.

Two flywheel accidents are reported this week. The 18-ft. wheel, weighing 5,000 tons, of the engine of the Hudson Electric Light Co., at Hoboken, N. J., burst Oct. 5, owing to the engine getting beyond control. One man was killed and three were injured.—— On Oct. 8 the wheel of the engine of the electric light plant at Homestead, Pa., burst while the engine was running at its ordinary speed. The engineman was killed.

A platform erected for spectators at the laying of the cornerstone of St. Mary's Church, Lorain, O., gave way Oct. 6, during the ceremony, and about 300 persons were thrown into the basement excavation. Only one person was killed, but about 25 persons were injured, ten probably fatally.

The rear collision between a runaway light engine and an excursion train which occurred on the Sea Beach R. R. Sept. 2 has been attributed by the State Board of Railroad Commissioners to the lack of ordinary care and judgment on the part of the engineman of the light engine. The Board also makes some recommendations as to the arrangement of the tracks. Of the 14 persons seriously injured, two have since died.

An electric car on the Larimer Ave. branch of the Duquesne Traction Co., Pittsburg, Pa., was recently derailed on a bridge, and the front end of the car went through the floor, but nobody was seriously injured. The track over this structure is said to be very rough, causing cars to pitch badly, but, nevertheless, the cars are often run across at high speed.

Bids for rapid-fire gun forgings were opened at the Navy Department on Oct. 3. The bids covered the forgings for 13 5-in. and 27 4-in. guns. The Bethlehem Iron Co. bid 29 cts. per lb. and the Midvale Steel Co. 28½ cts. for the 4-in. forgings and 30 cts. for the 5-in.

Tests of mechanical water filters are to be made at Minneapolis under the direction of Mr. F. W. Cappelen, City Engineer. It is proposed to filter the whole supply of the city. The average daily consumption for 1892, according to the report of the water department for that year, was about 14,400,000 gallons.

A scarcity of water at Troy, N. Y., has been experienced for some time, necessitating running the Hudson River pumps to their full capacity, and resulting in plans to put in a pump to lift this water from low to high service. A gravity supply is depended upon, in so far as it is adequate, the normal high-service supply being wholly by gravity. A new supply scheme was worked out some months ago, but it was temporarily defeated, or blocked, through alleged political influences.

A municipal electric lighting plant has just been completed at Detroit at a cost of about $640,000. The specifications for this plant were published in our issue of March 1, 1894, and the seven water-tube boilers were described in detail, with an inset sheet of illustrations, in our issue of June 30, 1895. According to previous reports, the service at present will be 1,500 arc lamps of 46 volts and 9.6 amperes each. At the close of 1894 the municipal electric lighting plant of Chicago had 1,273 street lamps, rated at 2,000 c. p. each. Allegheny City in 1894 claimed to rank next to Chicago in its city lighting plant, having 505 2,000-c. p. arc lamps in service early in 1894, and, in addition, 2,831 incandescent lamps of 16 c. p. each. It is interesting to note that all the light towers were to be removed in 1894. Mr. Alex. Dow, M. Inst. Elec. E., is Engineer of the Detroit Public Lighting Commission.

The Master Car Builders' Association is to hold its 30th annual convention at Saratoga, N. Y., commencing Wednesday, June 17, 1896. The date is one week later than that prescribed by the by-laws, the change having been made after consultation with the executive committee of the American Railway Master Mechanics' Association and the unanimous vote of the executive committees of both associations in favor thereof. The headquarters will be at Congress Hall.

The dynamometer car of the Pennsylvania R. R. has been sent to the engineering laboratory of Purdue University, to have its weighing apparatus checked by comparison with the Emery testing machine which constitutes the traction dynamometer in the Purdue locomotive laboratory.

SIXTY-INCH STEEL CONDUIT FOR THE WATER-WORKS OF ALLEGHENY, PA.

The city of Allegheny, Pa., is preparing to improve the quality of its water supply by building a new intake in the Allegheny River at Montrose, about 10 miles above the present intake. There will be a large pumping station at the new intake, from which the water will be forced through a 60-in. steel conduit, nearly 10 miles long, to the present distributing reservoir. This pipe is, we believe, the largest steel water-works conduit ever built. On the new water-works conduit at Rochester, N. Y., described and illustrated in our issue of April 11, 1895, there is some 60-in. steel pipe, but it extends for a distance of only 1,600 ft.

The following description of the manufacture and laying of this conduit has been prepared after a careful examination by a member of the staff of this journal, and with the aid of information courteously furnished by the engineers and contractors engaged on the work.

The new works have been designed throughout by Mr. Robert Swan, Supervising Engineer of the Allegheny water-works, and will have a capacity of about 50,000,000 gallons per day. The contract for the pipe line was let to T. A. & R. G. Gillespie, of Pittsburg, Pa., at $850,000, this contract including the pipe, valves, specials and pipe-laying complete. The pumping station is being built by the Jutte & Foley Co., of Pittsburg, Pa., and will be equipped with three compound, condensing, high-duty pumping engines, each of 12,000,000 gallons daily capacity, for which the Groshon High Duty Pumping Engine Co., of New York city, has the contract. The foundations for the pumping station are in a very soft and treacherous material, and the walls have been carried down 55 ft. to a thickness of 24 ft. at the base. The trench for the pipe line is largely in a sandy gravel, but also passes through rock and various other material. The backfilling was originally specified to be done with moist earth in layers 6 ins. deep, each thoroughly tamped, pounded and rammed. In practice the backfilling is tamped underneath and over the pipe, and then from the top of the pipe to the surface the trench is filled by a Little Giant road steam shovel, built by the Vulcan Iron Works, of Toledo, O., and similar to the one shown in our issue of Sept. 5. This fills in the material from the side of the trench, and the whole ditch is afterwards flooded by special apparatus, except in the streets of the boroughs and cities through which the conduit passes, and there the entire ditch is tamped, rammed and flooded. Work on the pipe line was commenced in June, and will probably be completed by December, although the contract time extends to January, 1896.

The specifications require all culverts, fills, abutments, etc., to be completed 30 days before the conduit is laid thereon, the fill to be at least 10 ft. deep over the crown of the culvert, and when fully settled to have a trench excavated for the pipe. Where the conduit pipe stretches across between two abutments or approaches, it is to be enclosed in a casing of 2-in. planed and matched white oak plank, with all necessary braces and other timbers, and the space between the pipe and the casing must be filled with non-conducting material. The casing must be given three coats of best white lead and linseed oil paint of approved color, and must be provided with hinged and locked trap doors. This class of work, however, occurs but rarely, most of the line being laid in a trench. Steel stiffening or anchor rings of angle irons 4½ × 3 ins., and weighing 12 lbs. per ft., are to be riveted to the outside of the pipe where it is to be anchored in masses of masonry, or wherever any unusual weight is to be supported directly by the pipe. The pipe line crosses under the Western Pennsylvania R. R. through a masonry culvert 167 ft. long.

The specifications for the pipe required the use of soft open-hearth steel, with a tensile strength of 55,000 to 65,000 lbs. per sq. in.; elastic limit, 32,000 lbs.; elongation, 25% longitudinally (in direction of rolling) and 22% transversely; reduction of area, 50%. The test pieces are 8 ins. long and 1½ ins. wide between measuring points. Bending test specimens not less than 6 ins. long and 1 in. wide, cut lengthwise and crosswise from the sheets, must, when cold, stand bending 180° upon themselves and hammering down flat without showing signs of fracture on the convex side. They must also stand this test after being heated to a dull red heat and quenched in water at 60° F. Drifting-test specimens are 3 ins. wide and 6 ins. long, with two punched ¾-in. holes, 2 ins. c. to c., on the center line of the specimen, the holes being enlarged while cold by a drift pin to twice their original diameter without developing any cracks. The plates must allow cold scarfing, or drawing to a fine edge, without showing signs of fracture. As to chemical composition, the steel must not contain more than

Fig. 1. 60-in. Steel Pipe Line for the Water Supply of Allegheny, Pa.; View showing Pneumatic Riveter at work in the Trench.

0.05% sulphur, 0.05% phosphorus, 0.05% silica and 0.50% manganese. The carbon is not specified, as it is limited by the physical test requirements, but averages 0.13%. The plates must be rolled flat and sheared as accurately as possible, being in no case short of the specified dimensions.

All shop rivets are open-hearth "soft" steel, with the same chemical requirements as the plates. Test pieces of rivet steel 8 ins. long and of the same diameter as the rivets, must have a tensile strength of 55,000 to 62,000 lbs. per sq. in.; elastic limit, 30,000 lbs.; elongation, 26%, and reduction of area, 50%. Both before and after being heated to a dull red and quenched in water at 60° F., they must stand bending double and flat without showing indications of fracture on the convex side. All field or hand riveting is done with the best extra refined, wrought iron rivets, soft and malleable, made from iron having a tensile strength of 50,000 lbs.; elastic limit, 26,000 lbs., and an elongation of 18% in 8 ins. Test specimens of the same diameter as the rivets must bend cold 180° to a curve whose diameter is equal to that of the rivet, without showing any fracture on the convex side. The steel rivets were manufactured by the Oliver Iron & Steel Co., of Pittsburg, and the wrought iron rivets by the same company and the Pittsburg Mfg. Co.

All castings are of tough gray metal, with a tensile strength of 18,000 to 24,000 lbs. in test specimens from which the external coating has been turned, planed or milled. When tested with the "skin" retained, a bar 1 × 1 in. and 40 ins. long on supports 36 ins. apart must sustain a gradually-applied load of 750 lbs. with a deflection of 0.4 to 0.6 in. at the center.

All plates and rivets must be kept free from rust, and in case of accidental rusting during transportation or manufacture, the rust must be at once removed by brushing with a stiff brush and scrubbing with dilute acid, followed by mopping or brushing with a saturated solution of soda or other suitable alkali to remove this acid. The alkali must then be washed off and the plate thoroughly dried.

In punching, the diameter of die must not exceed that of the punch by more than 1-16 in. All riveting in the shop must be done by hydraulic machinery, exerting a slow pressure, which must be maintained until the rivet is driven. At each intersection or lap of the longitudinal and circular seams, two specially long lap rivets are to be driven, extending through three thicknesses of plate. All longitudinal seams are double-riveted. All circular seams are single-riveted, except that the engineer may require double-riveting for all such seams for about 200 ft. on each side of stop-gates.

The pipe is made up in the shop in lengths of four courses, inside and outside courses alternating, the longitudinal seams not less than 12 or more than 30 ins. apart. In the trench the pipe line is laid so that the longitudinal seams of all inside courses are on top, and the longitudinal seams of all outside courses (except curves and angles) are in line and have the calking edges facing upward. For angles and curves the outside courses must be punched so as to form the proper angles at as many circular seams as may be required, no angle greater than 2½° being made at any one circular seam. The outside courses may have their seams at either side on the upper half of the pipe, but must have the calking edges facing upward. These special or curve pipes may be made in less than four sheets and in sheets less than 6 ft. wide, if deemed necessary. Reducers and taper courses must have the plates so cut and punched that the pitch lines of the rivets in the circular seams are parallel to each other, and have their planes parallel to each other and perpendicular to the axis of the pipe.

The edges of all plates are planed to the proper lines and beveled for calking all around, no beveling by shearing being allowed. The pipe is calked at all seams and joints, inside and outside, before any protection coating is applied. At the laps the thickness of the plates is reduced to a fine edge by hammering, and this thin portion has two long rivets, as above described. All field and shop calking is what is known as Connery's concave calking, no split calking being allowed.

The pipe requires about 8,500 tons of ½-in. steel plate, all of which was furnished by the Carnegie Steel Co., and the pipe is being manufactured by James McNiel & Bros. and Riter & Conley, both of Pittsburg, the former making 36,000 ft. and the latter 12,000 ft. of pipe. The contracting firm of T. A. & R. G. Gillespie is jointly interested in the manufacture of the pipe with James McNeil & Bro., as well as jointly interested in the coating

Fig. 2. View showing Reverse Curve at Sharpsburg.

plant, which was built specially for the purpose. Riter & Conley are sub-contractors, the contract having been given to them to help out the work after part of the plant of the main contractors had been destroyed by fire. The flat plates are shipped from the mill on covered flat cars, and each is in a wooden frame, which protects the edges. At the pipe works the plates are first punched by a double punch, which makes two holes at each stroke, and then the edges are planed to such a bevel that the edges and the straight side meet at an angle of 63°. From the planer the plates are passed to a steam hammer, by which the corners (heated to a yellow heat) are scarfed. The plate is

now ready for the bending rolls, by which it is bent to shape in one pass, after which the edges are bolted together ready for riveting. Four of these courses of plate are then bolted together at the circular seams, and the section of pipe thus made up is taken to the hydraulic riveting machine, over which it is suspended in a vertical position, the rivets being inserted from the outside and formed by a steady pressure of 65 tons on each rivet. When the length of pipe is all riveted, the seam edges are calked to a concave surface by a King pneumatic calking machine delivering about 10,000 blows per minute. The rivets

Fig. 3. View showing Vertical and Horizontal Curves at Sharpsburg.

are 1⅛ ins. diameter, 3 ins. long under the head with heads 1⅞ ins. diameter and 15-16 in. high. The general dimensions of the pipe are as follows:

Pipe:	
Nominal size	60 ins.
Thickness of plates	½ in.
Length of large plates	199⅜ ins.
" " small "	196 "
Width of all plates	73½ "
Inside diam. of large ring	61 "
" " " small "	60 "
Rivets, diam.	1⅛ "
Rivet holes, diam.	1 3-16 "
Circular seams:	
Rivets per seam, number	68
Circumference of large plates	193.396 ins.
" " small "	190.066 "
Rivet pitch, large ring	2.925 "
" " small "	2.879 "
Dist. cen. of rivet to edge of plate	1¾ "
Lap of sheets at circular seam	3½ "
Longitudinal seams:	
Rivets in first row (excl. of cir. seam), No.	14
" " 2d " " " " " "	13
" pitch, both rows	4.617 ins.
Dist. between rows	1¾ "
Diagonal pitch, approximate	2.90 "
Dist. cen. of rivet to edge of plate	1¾ "
Lap of longitudinal seam	5¼ "

McNiel & Bros. are turning out about 16 complete sections of pipe, ready for coating, in 24 hours, or eight sections from three riveting machines in 10 hours, the works running double time. Riter & Conley, working only one shift, turn out seven complete sections per day with two riveting machines. Both works together average an output of 100 joints per week, but cannot do more than supply material for the two pipelaying gangs.

The Sabin japanning process of coating the pipes (described in our issue of April 11, 1895) was adopted, although the specifications permitted bidders to bid on other processes if proved to be equal in every respect to the Sabin process, the requirements in any case being as follows:

> The coating must be smooth, hard yet tough, elastic and durable; free from blisters and bubbles, and not affected by exposure, nor by the action of the soil. It must strongly adhere to the pipe under all circumstances, must not become soft enough to flow when exposed to the sun in summer or brittle enough to scale off in winter, and must show no brittleness when applied to specimen plates which shall be immersed in water at 35° F., nor flow at a temperature of 150° F. The temperature of the coating bath should be about 300° F. The pipes may be dipped horizontally or vertically, as directed, being rolled in the bath if dipped horizontally.

Messrs. Gillespie are using the Sabin process, and have had a plant built by McNiel Bros., which is known as the Vulcan Enamel Works, and is owned jointly by these two firms. Messrs. Gillespie claim to be the only concern in the country which manufactures and lays steel pipe, and the only firm in a position to make, finish and lay the entire product of its own works. The lengths of pipe, weighing 8,500 to 8,700 lbs. each, are hauled to this plant, where each and every length is tested by hydraulic pressure to 90 or 100 lbs. per sq. in., any leaks being calked while the pipe is under test. After the length has been tested, emptied and dried, it is lifted up on end by an electric crane (the dynamo for which is run by a 25-HP. Buckeye engine) and lowered slowly into the bath. This bath is a cylindrical tank 6 ft. diameter and 25 ft. deep, sunk in the ground and containing the Sabin asphalt and oil composition. The temperature of the bath is about 220° F., and this was at first maintained by a steam coil in the tank, but this gave trouble through being struck by the descending pipes, and now the tank is fitted with a central steam drum 30 ins. in diameter, extending the full height of the tank. In one case the coil pipe was broken and the steam plastered the composition over one two pipes in a vertical position. The temperature of these ovens is raised slowly to 350° to 400° F. by natural gas (higher temperatures not giving good results), and here the pipes remain for five or six hours, during which the coating dries and hardens. At first the pipes were heated in the ovens before being dipped in the bath, but this was found to give no better results than the cold dipping.

From the oven the pipe is removed to the other end of the building, lowered horizontally onto a truck and run out into the storage yard, from which it is hauled to the work on wagons, with skids wrapped in straw pads to prevent any injury to the coating of the pipe. The coating is both hard and tough, and it is said that if scratched off and the iron wetted, the iron will not rust, owing to the oil from the composition having been forced into the iron. This plant coats about 22 lengths per day, and can handle 24 to 26 lengths, working double time. The composition used is furnished by Edward Smith & Co., of New York.

Each length of pipe is numbered, and its location is indicated on detail plans, so that the man in charge of the team knows just where to deliver it, and any particular length can be found at any time after the completion of the work. The pipe is lowered into the trench by a derrick, and the circular seams connecting adjacent lengths are bolted up with a sufficient number of bolts to prevent any pulling apart. The riveting is done by inserting the rivets from the inside and heading them up by pneumatic riveters outside the pipe, as shown in Fig. 1. The side excavations in the trench are to allow room for the field riveting. If the holes are not fair they are reamed from the inside. The manholes are 600 to 700 ft. apart, and small handholes are provided at intervals of 100 ft., After riveting, the joints (and any abraded portions of the pipe) are painted inside and outside with pure California asphalt, furnished by the Alcatraz Asphalt Co., of San Francisco, Cal. During the laying, riveting and calking in the trench, and while men are at work in and around the pipe, a strip of canvas 30 ins. wide is laid inside the pipe and also along the top.

The completed pipe line is tested to 115 lbs. per sq. in. by hydraulic pressure in lengths of about 1,000 ft., this being done before backfilling the trench, and special closing pieces are used to connect these lengths of pipe line. The working pressure will be from 110 to 120 lbs. at the pump end, decreasing to 25 or 30 lbs. at the reservoir end. All the specials were made by R. D. Wood & Co., of Philadelphia, Pa., and the immense gate valves (one of which was shown in our issue of Aug. 29) were made by the Rensselaer Mfg. Co., of Troy, N. Y. The Y castings, 60 × 60 × 60 ins., weigh 51,484 lbs., and the 60-in. gate valves weigh 50,000 lbs. Each special and valve is hauled from the railway on a four-wheeled truck or wagon with broad tires, and 24 horses are required in each case. Expansion joints are only used at the Y and gate connections, contraction and expansion on the main line being provided for by the curves, there being comparatively little straight pipe. Some of the vertical and horizontal curves are shown in Figs. 2 and 3.

The adoption of pipe line conduits of this kind bids fair to revolutionize to some extent the construction of water supply systems, as they may in many cases be adopted instead of tunnels, masonry aqueducts or cast iron conduits. The contractors for the Allegheny pipe line, T. A. & R. G. Gillespie, of Pittsburg, make a specialty of this class of work, and have previously laid 8,000 ft. of 50-in. steel pipe for the additional water supply of Pittsburg (in 1894), and the East Jersey Water Co.'s 36 and 48-in. pipe line for the supply of Newark and Paterson, N. J. (Eng. News, Aug. 21, 1891, and July 13, 1893). We are indebted to Mr. F. J. Gubelman, Assoc. M. Am. Soc. C. E., Principal Assistant Engineer of the Allegheny Water-Works, and to Mr. Frank Wilcox, Engineer for the contractors, for much of the information used in the preparation of this article, and we are indebted to the contractors for the accompanying views.

THE POPP-CONTI COMPRESSED-AIR CONDUIT SYSTEM FOR STREET RAILWAYS.

A low-pressure, compressed-air system of traction for street railways, in which the car reservoirs are automatically recharged at intervals along the line has recently been tried in Paris, and with such satisfactory results, according to "La Revue Technique," that the municipality of St. Quentin has given a concession to the company owning the system. The system is the invention of Mr. Victor Popp and Mr. James Conti, the former being well known in connection with the Popp system of transmission of power by compressed air at Paris, as described in our issues of Dec. 14 and and 21, 1889.

At the power station the air compressors charge storage reservoirs from which the supply main is charged, a governor being used to maintain a constant pressure in the main. The main is laid underground between the tracks, and has branches at intervals to the charging apparatus placed in vaults between the rails of each track. To charge the car, it is stopped over the hinged covers of the vault, one of the wheel flanges depressing a hinged tongue placed against the rail, and this tongue operates a valve, causing the air pressure in the main to force up a blade or feeder carrying two small valves. This blade engages with a special joint on the car, entering between two rubber lips. As soon as the car is stopped, by the operation of a cock on the platform, the two lips are inflated, making an airtight joint between the car and the blade, or feeder, while at the same time the operating crank handles on the platform are disconnected. The feeder is hollow and fitted with valves which, when operated by the pressure of the air remaining in the car reservoirs, open communication between the supply main and these reservoirs. In a few seconds the reservoirs are charged, the crank handles are automatically connected and a whistle signals the car driver to close the cock, when the lips of the joint relax and free the feeder. As the car moves on the spring tongue rises to its original position against the rail head, causing the feeder to descend into the vault, the covers dropping down level with the street surface. The apparatus at any one vault can be thrown out of operation for inspection or repairs without affecting the rest of the system.

The car body is carried on an iron truck frame with four wheels, having plate springs over the axle boxes, while the body rests on four plate springs placed at the ends of the truck frame. The two axles are connected by coupling rods. The motor is a two-cylinder compound engine, with variable expansion, placed under the middle of the car and driving the end cranks of a short shaft carrying a pinion which gears with a spur wheel on one of the car axles. The slide valves are driven by eccentrics on return cranks, and the engine can be worked as a simple engine when required. The air is heated before entering the smaller cylinder, and again before entering the larger cylinder, the heater having a small coke fire, fed by a hopper, which only requires to be attended to once a day. The reservoirs, heater and all the machinery are under the car and the platforms are unobstructed. The car can run in either direction.

TESTS OF PAVING BRICK AT NEWARK, N. J.

Among the cities which are now turning their attention to brick as a paving material is Newark, N. J. In our issue of Aug. 22 this city advertised for proposals for such paving, and on Aug. 29 awarded the contract as stated below. Through the courtesy of Mr. M. R. Sherrerd, Assoc. M. Am. Soc. C. E., Engineer of Newark's Department of Water, we are enabled to give that part of the specifications which relates to the tests of brick and also the results of the tests of samples submitted. The extract from the specifications is as follows:

The bricks and blocks must be capable of standing the following tests:

They shall not absorb more than 3% of their own weight in water after being broken and dried in an oven and then immersed for 24 hours.

They shall not lose more than an average of 8% in an abrasion test conducted in the following manner and under similar conditions as the tests heretofore made by the Board. The bricks will be placed in a rumbler 21 ins. in diameter, making from 43 to 45 revs. per min., and containing 150 lbs. of rough scrap iron, a majority of the pieces weighing about 1 lb., and three pieces about 4 lbs. each (it is intended in conducting this test to use the same scrap iron with an additional weight sufficient to bring it up to 150 lbs., as was used in a comparative test heretofore made), the result in percentage lost being an average of the following three percentages:

(1) The percentage lost in the first 20, (2) the second 20, and (3) the above 40 minutes. Bricks and blocks will be placed separately in the rumbler.

All bricks or blocks must give modulus of rupture of not less than 1,800 when tested on their sides, being supported on knife edges 6 ins. apart. The above coefficients to be calculated by the formula

$$\text{Modulus} = \frac{3\,W\,L}{2\,A\,D},$$

in which W equals breaking weight at the center; L equals length between supports; A equals area section; D equals depth.

The Board reserves the right to accept bids for bricks or blocks which have successfully passed the above requirements in the test heretofore referred to, made under their direction. If samples are submitted on other bricks or blocks, they will be subjected to similar comparative tests to those heretofore mentioned, and if samples do not meet these requirements, bids upon such bricks or blocks will be informal, and not considered.

The make of the bricks tested and the results obtained are presented in the accompanying table. It will be seen that of 36 samples tested 23 were thrown out for non-compliance with the specifications in one or more particulars.

The contract for paving four short streets with brick on 6 ins. of concrete, the contractor doing the excavation and furnishing and laying the concrete, was awarded to Homer & Co., Olean, N. Y., the streets, quantities, kind of brick and price being as follows: Congress St., 7,900 sq. yds., Canton repressed shale brick, at $2.26 per sq. yd.; Prospect St., 5,700 sq. yds., Mack repressed fireclay brick, $2.27 per sq. yd.; South 10th St., 6,100 sq. yds., Canton shale standard (wire cut) brick at $2.12 per sq. yd.; Johnson Ave., 8,600 sq. yds., Mack repressed fireclay grooved block, at $2.22 per sq. yd.

Results of Tests of Street Paving Brick at Newark, N. J.

Name of brick.	P. c. by wt. Absorption.	Loss by abrasion.	Modulus of rupture, lbs.
Mack repressed shale brick	2.8	7.3	2,143
" fireclay grooved block	2.8	8.0	2,164
" repressed fireclay brick	2.5	7.2	2,470
" wire-cut shale brick	2.8	*8.8	2,111
" fireclay wire-cut brick	*5.4	7.8	1,966
" repressed shale block	2.2	6.5	2,822
MacMahon, Porter & Co.:			
Wire-cut fireclay brick	*3.9	6.7	2,311
Repressed brick	*3.9	*8.6	*1,510
Kountz Bros. & Co. wire-cut shale bk.	2.4	*10.5	3,623
Brick Exchange, Canton, O.:			
Wire-cut shale brick	2.6	7.3	2,065
Catskill shale block	2.7	*10.9	1,884
American Fire Clay Co., Toronto, O.:			
Wire-cut brick	*3.7	*8.8	2,568
Repressed brick	2.3	8.0	1,838
" block	2.8	*10.0	*1,551
Athens Brick Co. wire-cut shale brk.	*4.6	*11.3	2,268
" " " shale brick	3.0	*11.2	2,132
Minerva Paving Co.:			
Wire-cut fireclay brick	*3.8	*9.0	*1,242
Fireclay brick	2.2	*12.7	*1,691
Canton repressed shale brick	0.9	6.5	2,004
Imperial Metropolitan block	1.3	5.6	2,582
Royal Block, Canton O.	1.3	5.3	2,840
Shale brick, Canton, O.	1.1	*8.9	*1,551
Natural repressed shale brick	*5.7	*11.9	*1,370
Hocking block	0.5	6.7	2,118
Syracuse wire-cut brick	0.0	5.9	3,912
Clearfield brick	1.5	7.8	2,139
" block	*4.5	*8.5	2,430
Scranton repressed block	1.5	*10.9	2,114
Park Fire Clay Co. wire-cut brick	*3.7	*11.0	*1,533
" " " " repressed brick	*4.1	*9.4	*1,412
Richardson No. 1 brick†	0.0	6.7	2,372
" No. 2 " †	2.2	*8.9	1,880
" No. 3 " †	2.1	*8.6	*1,604
" No. 4 " †	2.1	*10.2	1,948
" No. 5 " †	*4.9	6.9	1,980

* Thrown out for not coming within specification limits: Absorption, not over 3%; loss on abrasion, not over 8%; modulus of rupture, not less than 1,800 lbs.
† Name of manufacturer not given.

Since the above was written Mr. Sherrerd informs us that a further contract has been awarded, this time to T. McManus, of Newark, for about 20,000 sq. yds. of Mack repressed fireclay grooved block on Roseville Ave., at $2.15 per sq. yd. The specifications for the latter contract stated that bids would be considered on new makes of brick, providing the bidder would give a guarantee bond for eight years, instead of only for five years, as required of brick which had been in successful use for two years.

Mr. Sherrerd states that as a result of his experience in testing paving brick in other cities, he is convinced that some modification of the abrasion test should be made, and that he is now experimenting with that end in view.

PROSPECTS FOR A SHIP CANAL FROM THE GREAT LAKES TO THE HUDSON.

By Thos. C. Clarke, M. Am. Soc. C. E.

At the Toronto convention last year, Mr. Coo'ey spoke the plain truth when he said: "The line of domestic transportation determines the line of foreign shipment."

The history of the New York and Canadian canals shows this so clearly that he who runs may read. These canals were begun about the same time, and have been gradually enlarged until the Erie Canal can now pass boats of 250 tons burden, and the Canadian canals vessels of about four times that capacity. The distance from Chicago to New York by the Erie Canal and the lakes is 1,373 miles, of which 350 miles is artificial navigation. That from Chicago to Montreal is 1,263 miles, of which but 70 is artificial navigation.

Owing to the less total distance and greater length of deep water, grain was carried from Chicago to Montreal for an average rate per bushel, in 1893, of 5⅝ cts., while the rate from Chicago to New York by the lakes was, in 1893, 6¼ cts. per bushel.

Notwithstanding the higher cost by the Erie Canal route, its tonnage in 1893 was 4,275,662 tons, and that of the Welland 1,294,823 tons, of which only 663,156 tons went to Montreal; the rest crossed Lake Ontario and went to New York.

The reason why so much more freight goes to New York than by the cheaper route to Montreal is because the greater part is intended for domestic consumption, and New York is a better market than Montreal. Hence it is agreed, by Americans, at least, that New York is the port to be aimed at, and the question is how to cheapen transportation thither.

The cost of transportation can be lessened either by very deep ship canals or by canals deeper than those at present in use, connecting with lake vessels and requiring trans-shipment. If a ship canal is built at all it should be deep. The Suez Canal is 27 ft. deep, and the ships passing through it draw so much water that there is seldom over 2 ft. of water under their keels. The best speed they can make is 4½ miles an hour. A ship canal between our lakes and the ocean should at least provide for a vessel like the new steamer "Victory," 380 × 48 ft., and carrying on 20 ft. draft 7,000 net tons, or 233,000 bushels of grain. The prism of the canal should have a bottom width of 150 ft. and a depth of not less than 25 ft.

The economical speed of a steamer like the "Victory" in deep water is 13 miles an hour, and in such a canal, with 5 or 6 ft. of water under her keel, she should make seven miles an hour. With modern improved locks the time of lockage, including slowing, should not exceed half an hour. Unless the ship canal is given these dimensions, transportation through it will not be as economical as by a canal of 9 ft. deep, including cost of transferring into barges, as we shall hereafter show.

Without going into long descriptions, we may say at once that there is but one place where such a large ship canal as we have described could possibly be built.

* A paper read at the first annual meeting of the International Deep Waterways Association.

The routes suggested for ship canals are:

Looking at the less cost of transportation to Montreal, it has naturally enough been thought by some persons that if the Welland and St. Lawrence canals could be deepened to 20 ft., and their locks enlarged to the capacity of the St. Mary's Falls Canal, and if the present small canals connecting Lake Champlain on the north with the St. Lawrence, and on the south with the Hudson, could also be made ship canals, this would be the true solution of the problem. The distance from Chicago to New York is 1,670 miles, of which 175 miles would be artificial navigation. Twenty feet would not answer, and to make these canals 25 ft. deep would require many miles of under-water rock excavation in the St. Lawrence and in Lake Champlain. The Welland, St. Lawrence and Champlain canals would have to be entirely rebuilt, but the most serious difficulty would be want of water.

There is a summit between Lake Champlain and the Hudson of 54 ft., and the topography of the country would prevent cutting deep enough to feed the Champlain Canal from Lake Champlain. The necessary amount of water for navigation could only be supplied by constructing vast storage reservoirs, sufficient to hold the whole rainfall of the Eastern Adirondacks, and cutting off the water from many manufacturing interests now supplied by it.

The cost of a ship canal (one 20 ft. deep), including the enlargement of the Canadian canals, which would have to be done by the Dominion Government, is estimated by E. L. Corthell, civil engineer, a very high authority, at a total of $102,000,000, without damages for diversion of water. To make it 25 ft. deep would be impracticable on account of cost. Moreover, in case of war, the Canadian end of this route could be shut by Canada, while their own canals would remain open and give access for warships to the upper lakes. Thus from a military point of view, it is undesirable, while commercially we shall show later that it is not as economical for transportation as a less expensive route.

Plans for improving the Erie Canal were suggested by Mr. Sweet, State Engineer, in his report to the Legislature of New York 10 years ago. He says: "There are two methods of improving the Erie Canal and, in my opinion, only two worthy of consideration. The first is to increase its depth one or two feet by such deepening of the channel and raising of the banks as are consistent with maintaining the integrity of its present structures, and to lengthen the locks to facilitate the use of steam by permitting boats to be locked in pairs. This system of improvement would give the best attainable result for the boats now in use, and to the consort system of steam towage for their movement. The second method is to enlarge it to such an extent as to make it available for the steamers navigating the lakes—a class of vessels of large tonnage and moderate power and speed, which are rapidly displacing all other merchant marine for freight traffic on the lakes and on the ocean."

In a paper read before the American Society of Civil Engineers in 1886 he proposed to enlarge the whole Erie Canal to 18 ft. in depth, increase the size of its locks and prism for lake vessels, and feed the whole from Lake Erie. His rough estimate was $150,000,000.

It may be confidently stated that the increase in the dimensions of lake steamers during the last 10 years has been so great that a canal 18 ft. deep would be of no use. It would not compete with the first-suggested plan of deepening the canal to 9 ft., and trans-shipping into steam fleets. This we shall show by figures.

If any ship canal at all is to be built, it must be not less than 25 ft. deep. It appears to the writer that a more favorable route would be via Oswego, Lake Ontario, and a 25-ft. ship canal, 26 miles long, around Niagara Falls. Possibly Oneida Lake, 25 miles long, would form part of the route. Such a scheme would still require moderate enlargement of the Erie Canal from Utica to Buffalo, and removal of the droop, as the new canal would have to be fed from Lake Erie. The distance from Chicago to New York would be about the same as by way of Buffalo. There would be 230 miles of artificial navigation, as against 350 by the Erie Canal.

The cost of either of these schemes would be very great, certainly far in excess of the sum named by Mr. Sweet. Both schemes would require turning the Mohawk River and its narrow valley into a series of lakes, and moving the New York Central and West Shore railroads, besides many dams, factories, and villages. Careful surveys should be made to ascertain the cost of both of these routes.

The present Erie Canal, though nominally 7 ft., is less in some places. Navigation is now carried on by horse boats, running in pairs, and by steam tugs towing three or four boats after them. These boats are of about 250 tons capacity, and that of the two-horse boats is 500 tons. That of the steam tows, including the tugboat, about 900. They average 2½ miles an hour while in motion, and, including lockages, run through from Buffalo to New York in 9 days, and, including 12 days in port, make 7 trips per season. The low cost of steam

towing has brought down rates, so that the horse boats make very little money.

The people of the state of New York will vote on Nov. 1 on the question of deepening the canals to 9 ft., and lengthening the few remaining short locks to admit of two boats at once. All the locks on the Erie Canal are double, so that boats can pass each other without delay. An experiment will soon be tried to ascertain the practicability of electric towing. If successful, it will be a great help to the owners of horse boats, who have not capital to invest in steam tugs. Every man can hitch his boat to the electric trolley, paying so much per day for its use. Another experiment, due to the energy of citizens of Cleveland, has just been tried of sending a fleet of tugs, each drawing five steel barges from Cleveland to Buffalo, and thence through the Erie Canal to New York. Owing to the shallow depth of the canal, no better time was made than at present.

But if the canal were uniformly deepened to 9 ft., and the remaining 32 locks doubled in length, a fleet of five barges could go from Cleveland to New York in 6 or 7 days. Better organization would reduce the time spent in port, so that nine trips could be made in a season. With 7½ ft. draft, 1,500 tons could be carried. The effect would be to greatly lessen the cost of transportation, as will be seen.

A comparative statement has been prepared giving the cost of transportation by the present Erie Canal, improved canals, and by several proposed ship canals. The figures upon which it is based will be found in detail in the appendix to this paper. These have been got from the valuable report of John Bogart, State Engineer of New York in 1891, from data as to lake boats, furnished by W. J. Babcock, Manager of the Chicago Shipbuilding Co., and from data as to the Cleveland steel barges, for which I am indebted to C. A. Wheeler, manager of the line. In order to arrive at the cost, we are obliged to make an estimate of the probable receipts in both directions. The assumption in all cases is that vessels and barges carry full cargoes of grain going east, and two-thirds full of merchandise going west. This makes the rates somewhat less than actual rates, when allowance has to be made for the contingencies of short cargoes. As the rule applies to all alike, the comparison is a fair one.

The routes are, in all cases, from Chicago to New York.

No. 1.—Large steamers on lakes and one tug with three wooden barges on present Erie Canal, including cost of elevating at Buffalo and trimming. Cost per bushel, 4¾ cts.

No. 2.—Large steamers on lakes, Chicago to Cleveland, elevating and trimming at Cleveland, with fleets of one tug and five steel barges on Erie Canal deepened to 9 ft. Cost per bushel, 2¾ cts.

No. 3.—Large steamers, Chicago to Oswego, passing through Niagara Falls ship canal 25 ft. deep, trans-shipment at Oswego, including elevating and trimming, into fleets of tug and five steel barges on Oswego and Erie Canal deepened to 9 ft. Cost per bushel, 3 cts.

No. 4.—Large steamers, Chicago to New York, passing through Niagara Falls, Oswego and Erie ship canals, all 25 ft. deep. Cost per bushel, 2.35 cts.

No. 5.—Large steamers, Chicago to New York, passing through Welland, St. Lawrence, and Champlain ship canals deepened to 20 ft., 4½ cts. Or if 25 ft. deep, 3 cts.

(Note.—As it is barely possible to improve the Champlain route to 20 ft., it is thought proper to give the cost by this route for that depth, and as an illustration of the value of depth, to also give the cost if 25 ft. deep.)

No. 6.—Erie Canal enlarged to 18 ft. deep, as proposed by Mr. Sweet, steamers carrying 5,000 bushels on 16 ft. draft, cost 6 cts. per bushel, Chicago to New York, or more than cost at present.

No. 7.—Erie Canal deepened to 9 ft. Fleets of one tug and four steel barges, running on lakes and canal. Cost, Chicago to New York, 2 cts.

The application of better methods of loading and unloading on the Erie Canal would lessen the number of days in port, and increase the number of annual trips.

The speed with which it is now done is marvelous. Mr. Babcock says:

The steamer "Victory" unloaded 3,600 tons of ore in 10 hours. Coal cargoes of 5,000 to 6,000 tons are loaded from pockets in two or three hours, by machinery in 10 hours, and unloaded in about two days.

Grain cargoes are spouted in two or three hours, and unloaded in six to eight.

Package freight, in conveniently-arranged boats, with first-class hoisting machinery, has been handled at the rate of 300 tons per hour.

Western forwarders know how to handle their end of the route, and if New York wants to keep the other end she must go and do likewise.

Conclusions.

Ship canals on the Canadian and Lake Champlain routes are not needed either from a commerical or a military point of view.

The enlargement of the whole Erie Canal into a ship canal would be very expensive, and of less commercial value than the Oswego and Niagara Falls route.

Public opinion should concentrate itself upon the following things:

First—Immediate improvement of the Erie and Oswego canals, upon which a vote is soon to be taken.

Second—Construction of a ship canal not less than 25 ft. deep around the Falls of Niagara.

Third—Surveying the Oswego and Albany route, to see if such a canal can be built within practicable limits of cost.

Fourth—If fleets of steel barges can be built and insured so as to run both on the canal and on the lakes, the cost of transportation by them would be less than by a ship canal.

APPENDIX.

Cost of Transportation.

Chicago to Buffalo, large steamers, loaded to 18 ft., carrying 6,000 tons.

No. 1.—Description:

Distance from Chicago to Buffalo, 870 miles; speed per hour, 13 miles; time, one way, 67 hours; round trip, 134 hours, or 5½ days. Time in Ports—At Chicago, 3 days; at Detroit, 1 day; at Toledo, 1 day; at Cleveland, 1 day; at Buffalo, 3 days; total in ports, 9½ days; total for round trip, 15 days; for season of 225 days, 15 trips of 15 days each. Cost of running 225 days, at $250 per day, $56,250; depreciation, repairs, insurance, and other expenses, $43,750; interest of 10% on $200,000, $20,000; cost per season, $120,000. Estimated Receipts per Trip—Full cargoes east, 6,000 tons, equaling 200,000 bushels, at 1¼ cts. per bushel, $2,500; two-thirds cargoes west, 4,000 tons of merchandise, at $1.50 per ton, $6,000; total receipts, round trip, $8,500; 15 trips at $8,500 each, $127,500; calculated rate per bushel, 1¼ cts.; actual rate, 1¼ cts. to 2 cts.

With Erie Canal 7 ft. deep.—Description:

Fleets of 1 tug of 180 tons and 3 barges of 250 tons each, or 930 tons in all. Distance from Buffalo to New York, 493 miles; speed per hour, 2½ miles; running time per trip, 200 hours; 72 lockages, 20 hours; actual time per trip, 220 hours; time per round trip, 440 hours, or 18 days; actual time in port, 12 days; total time for round trip, 30 days. In the season of 7 months 7 trips can be made, which is the average at present. Erie Canal.—Running expenses, 7 months, $5,300; repairs, depreciation and winter storage, $2,100; interest on $18,500 at 10%, $1,850; total, $9,250. Assumed Receipts per Trip.—East, 930 tons, or 31,000 bushels, grain, at 2½ cts. (1895, advance 1¾ cts.) per bushel, $723; west, two-thirds of a load of merchandise, 600 tons, at $1 per ton, $600; receipts, round trip, $1,322; receipts for season, or 7 trips, $9,261. Total cost from Chicago to New York: Chicago to Buffalo, as per No. 1, 1.25 cts.; elevator at Buffalo, ⅜ ct. per bushel, .375 ct.; canal transportation, 2.333 cts.; trimming, etc., .375 ct.; total, 4.73 cts. per bushel; actual rates, 5 to 7 cts.

No. 2.—Large steamers on lakes, Chicago to Cleveland, elevating and trimming at Cleveland into fleets of 1 tug and 5 steel barges on Erie Canal, deepened to 9 ft., etc. Capacity, 7½ ft. draft, is 1,500 tons. Distance, Cleveland to Buffalo, 174 miles; speed per hour, 6 miles; time, 29 hours. Distance, Buffalo to Albany, 250 miles; speed in motion, 4 miles per hour; time, 87½ hours; all locks lengthened for two boats; time of lockages, 15.5 hours. Albany to New York, 143 miles; speed, 6 miles per hour; time, 24 hours; total running time, 156 hours; round trip, 312 hours, or 13 days; time in port, 12 days; total time, round trip, 25 days, giving 8 round trips per season of 210 days.

Expenses.—Ten per cent. interest on cost of fleet worth $40,000, $4,000; 210 days' running expenses at $30 per day, $6,300; insurance and all other expenses, $7,700; total expenses per season, $18,000.

Estimated Receipts.—Full cargoes of grain going east, 1,500 tons, or 50,000 bushels, at 1½ cts. per bushel, $750; two-thirds of a cargo of merchandise going west, 1,000 tons, at $1.50 per ton, $1,500; total receipts one round trip, $2,250; total receipts, 8 round trips, $18,000. Cleveland to New York, 1½ cts. per bushel.

Cost of carrying grain from Chicago to Cleveland in large boats, including cost of transferring, should not exceed 1¼ cts. per bushel, making total cost per bushel from Chicago to New York by this route 2¾ cts., on the above supposition as to size of cargoes.

No. 3.—Large steamers, 7,000 tons burden, loaded to 20 ft., Chicago to Oswego, passing through Niagara Falls Ship Canal, 25 ft. deep; trans-shipment at Oswego (including elevators, trimming) into fleets of 1 tug and 5 steel barges on Oswego and Erie canals, deepened to 9 ft. Distance, Chicago to Buffalo, 870 miles; speed per hour, 13 miles; time, 67 hours. Niagara Canal, 26 miles; speed per hour, 7 miles; time, 4 hours; 10 lockages, at half an hour each, 5 hours. Lake Ontario, 120 miles; speed per hour, 13 miles; time, 9 hours; total running time, 85 hours; round trip, 170 hours, or 7 days; in port, 10 days; total, 17 days, making a total of 13 trips in a season of 220 days. Expenses nearly the same as No. 1—$122,000.

Assumed Receipts.—233,000 bushels grain at 1¼ cts. per bushel, $2,912; two-thirds of a cargo going west, 4,666 tons, at $1.50 per ton, $7,000; total receipts, round trip, $9,912; giving $128,852 for season of 13 round trips. Cost per bushel, 1¼ cts.

Oswego Canal, 38 miles; Erie Canal, 106 miles; total, 204 miles; speed per hour, 4 miles; time, 51 hours; lockages, 26, at a half-hour each, 13 hours. Hudson River, 143 miles; speed per hour, 6 miles; time, 24 hours; total running time, 88 hours; round trip, 176 hours, or 7 days and 8 hours; time in port, 7 days 16 hours; total, 15 days, giving 14 round trips per season.

Assumed Receipts.—50,000 bushels at ¾ ct. per bushel, $375 going east; 1,000 tons merchandise at $1 per ton, $1,000, going west; total, round trip, $1,375; for 14 round trips, $17,500. Expenses same as No. 2. Total cost, Chicago to New York.—Chicago to Oswego, 1.25 cts.; elevator, .875 ct.; trimming, etc., .275 ct.; canal, Oswego to New York, .75 ct.; total cost per bushel, 3.15 cts. Rates for elevators would probably be reduced by competition between Buffalo and Oswego, so that we may call the cost 3 cts.

No. 4.—Large steamers, carrying 7,000 tons on 20 ft. draft, from Chicago to New York, passing through Niagara Falls, Oswego, and Erie ship canals, all 25 ft. deep. Distance by lakes and rivers, Chicago to Buffalo, 870 miles; Lake Ontario, 120 miles; Hudson River, 143 miles; total distance, 1,133 miles; at 13 miles per hour, the time is 87 hours. Canals.—Niagara, 26 miles; Oswego, 38 miles; Erie, 106 miles; total, 230 miles; at 7 miles per hour, the time is 33 hours. Lockages.—Niagara, 10; Oswego, 6; Erie, 20; total, 36; at half an hour each, 18 hours; total time, 138 hours; round trip, 276 hours, or 11½ days; in port, 13 days; total time, round trip, 24½ days, giving 8½ round trips in a season of 210 days.

Estimated Receipts.—Going east, 233,000 bushels, at 2.35 cts. per bushel, $5,490; going west, 4,666 tons merchandise, at $2 per ton, $9,332; total, round trip, $14,822; for 8½ round trips, $125,987. Cost, Chicago to New York, 2.35 cts. per bushel. This is 66.6 cts. per net ton for a distance of 1,363 miles, or about one-half of 1 mill per ton per mile. This is less than the cost of conveying freight on long sea voyages in vessels of 28 ft. draft. In view of this, what becomes of the proposal to send ocean vessels to the upper lakes?

No. 5.—Steamers loaded to 18 ft., 6,000 tons burden, passing from Chicago to New York through improved Welland, St. Lawrence, and Champlain canals, 20 ft. deep. Distance from Chicago to foot of Lake St. Francis, on the St. Lawrence, including lakes, 1,024 miles; speed per hour, 13 miles; time, 78 hours. St. Lawrence River, 161 miles; speed per hour, 10 miles; time, 16 hours. Welland and St. Lawrence canals, 70 miles; speed per hour, 4 miles; time, 17.5 hours; lockages, 53; at half-hour each, 26.5 hours; total, 136 hours. Caughnawaga Canal, 38 miles; speed per hour, 4 miles; time, 9.5 hours. Richelieu River, 24 miles; Lake Champlain, 112 miles, or 136 miles in all; speed per hour, 13 miles; total, 10.5 hours. Champlain Canal, 67 miles; speed, 4 miles an hour; time, 17 hours; lockages, 12; at half-hour each, 6 hours. Hudson River, 143 miles; speed per hour, 13 miles; time, 11 hours; total running time, 54 hours; grand total, 190 hours; round trip, 380 hours, or, say, 16 days; time in port, 13 days; round trip, 29 days, or 7 trips per year.

Assumed expenses, as per No. 1, $120,000. Assumed Receipts.—200,000 bushels, at 4½ cts. per bushel, $9,000; 4,000 tons merchandise, at $2 per ton, $8,000; total, round trip, $17,000; total, 7 trips $119,000. If these canals could be made 25 ft. deep, boats of 7,000 tons could then make 8 trips per season, and move at 6 miles per hour instead of 4. This would reduce the cost of carrying grain east to New York to 3 cts. per bushel. Total distance, 1,639 miles, of which 175 miles would be artificial navigation.

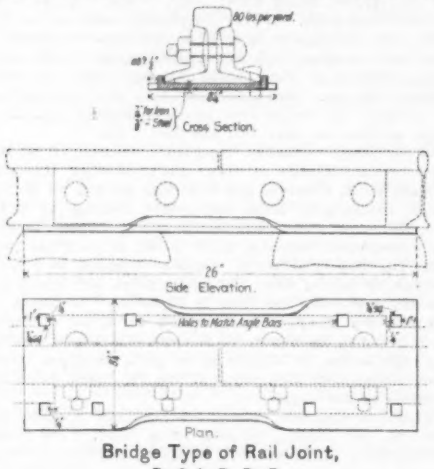
No. 6 (Erie Canal enlarged to 18 ft. deep).—Large steamers, carrying 5,000 tons on 16 ft. draft. Distance, Chicago to Buffalo, lakes, 870 miles; Hudson River, 143 miles; total, 1,013 miles, at 13 miles an hour; time, 78 hours. Canal, 350 miles; speed per hour, 4 miles; time, 87.5 hours; lockages, 72; reduced to 50, at half-hour each, 25 hours; total time in motion, 190.5 hours; round trip, 381 hours, or 16 days; time in port, 13 days; total, 29 days, or 7 round trips per season of 210 days. Yearly expenses reduced to $112,000.

Estimated Receipts.—East, 5,000 tons, or 166,500 bushels, at 6 cts., $10,000; west, two-thirds of a cargo, 3,333 tons general merchandise, at $2 per ton, $6,666; total, $16,666 per trip; 7 trips, $116,620. Cost per bushel, 6 cts., as against 2.35 cts. on a 25-ft. navigation via Oswego, showing the great value of depth of water as allowing larger cargoes and greater speed.

No. 7.—Erie Canal deepened to 9 ft. Fleets of 1 tugboat and 4 steel barges, 180 by 17½, loaded to 7½ ft. draft, capacity 2,400 tons. The time would be as follows: Lakes and river, 1,013 miles, at 6 miles an hour, 169 hours; canal, 350 miles, at 4 miles an hour, 87.5 hours; lockages, 15.5 hours; total in motion, 272 hours by 2, 544 hours, or 23 days. Time in port, 13 days, or 36 days per round trip, allowing of 6 round trips per season. Expenses, on same basis as before estimated, $24,000. Estimated receipts, cargo now carried, 2,400 tons in 4 barges, 80,000 bushels at 2 cts., $1,600; 1,000 tons freight, $2, $3,200; total per trip, $4,800; $4,800 multiplied by 6 trips is $28,800. Cost of conveying a bushel of grain from Chicago to New York, 2 cts. a bushel.

BRIDGE TYPE OF RAIL JOINT; DULUTH & IRON RANGE R. R.

We have more than once had occasion to call attention to the increasing use of the bridge joint for railway track, and the advantages of this type of joint over the ordinary suspended joint, due to the uniform bearing afforded to the rail ends. We



Bridge Type of Rail Joint, D. & I. R. R. R.

illustrate this week a simple form of bridge joint used with 80-lb. rails (Michigan Central R. R. section) on the Duluth & Iron Range R. R., which somewhat resembles that of the Chicago & Northwestern Ry., illustrated in our issue of Sept. 7, 1893. The plate is 26 ins. long, 8¼ ins. wide at the ends, and somewhat narrower at the middle, the edges being turned up about ½ in., or as high as the metal will work without reducing the thickness. Iron plates are 7-16 in. thick, and steel plates ⅝ in. thick. Each end has four holes ¾ in. square, two being made to match the spike slots in the angle bars. The splice bars are Samson angle bars, 22 ins. long, with four bolts spaced 6, 7 and 6 ins. c. to c. The joint ties are about 9 ins. wide, with a clear spacing of 8 ins. For the blueprints from which our cut is made we are indebted to Mr. R. Angst, Chief Engineer, Duluth & Iron Range R. R.

THE NEW UNITED STATES GOVERNMENT LOCK AT SAULT STE. MARIE, MICH.

II.

Lock Gates, Anchorages and Culvert Valves.

(With Inset.)

In our issue of Sept. 26 we illustrated and described the masonry and floor construction of the 800 × 100-ft. ship lock now being constructed at Sault Ste. Marie, Mich., by the United States Government. We continue the description of this important work in this issue with illustrations of the gates and valves for controlling the filling and emptying of the lock chamber.

Lock Gates.—The lock gates are constructed of open-hearth steel, and are the largest in the world. There are five of these gates, each consisting of two leaves—viz., an upper and lower lock gate, an upper and lower guard gate and an intermediate lock gate. The south leaf of the lower lock gate only is illustrated herewith, but these drawings apply in all dimensions to the construction of the intermediate lock gates, and also in the general character of the construction to the other gates. Each gate is composed of two leaves, the median line of which is the arc of a circle with a radius of 77 ft. 3.38 ins. The chord of this median line, or the distance between centers of quoin posts, is 103 ft. 5.08 ins., and the chord of each leaf from the center of the quoin post to the center of the face of the miter post is 55 ft. 4.69 ins. The radius in height, which is all made in the two uppermost cells. Turning to the illustrations, it will be seen that each leaf of the lower and intermediate lock gates has 18 horizontal webs, or arches, forming 17 cells. The nine lower cells constitute buoyancy chambers.

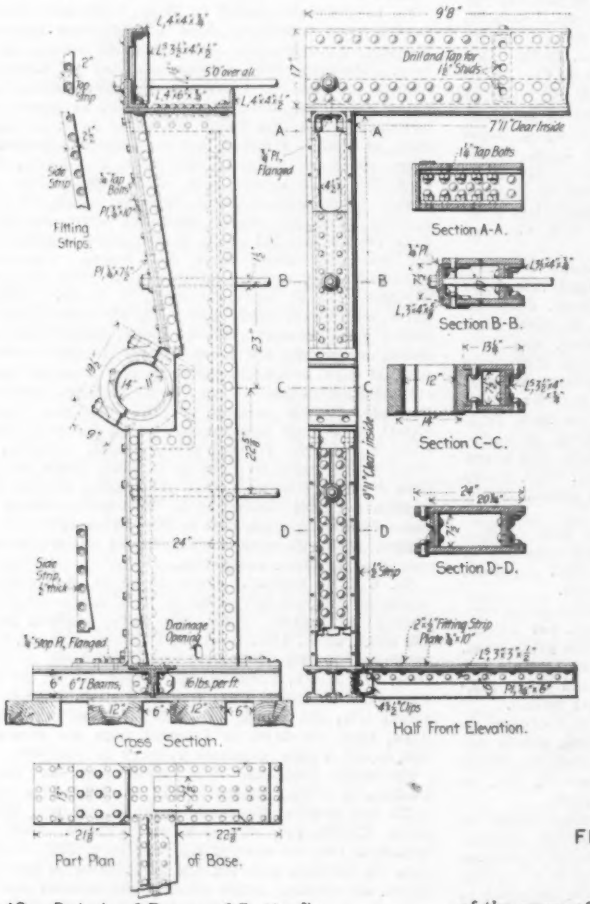
Material and Workmanship.—With the exception of the cast steel bedplates, about 9,000 lbs. of iron castings used for pump bearings and covers, the bronze bushings of various character and the wooden cushions, the gates are entirely of open-hearth rolled steel. Two qualities of steel were used—viz., soft steel for the gate leaves and forged and high carbon steel for parts of the anchorage connections, bearings, etc. The requirements for these two classes of steel were:

	High steel.	Soft steel.
Maximum ult. strength, lbs. per sq. in.	74,000	63,000
Minimum " " " " " "	69,000	58,000
" elastic limit, lbs. per sq. in.	38,000	32,000
" percentage of elongation in 8 ins.	18	25
" " reduction at fracture	38	50

The specifications also require that before and after heating to a cherry red heat and cooling in water at 80° F., the soft steel should stand bending through 180°, and closing up against itself without cracking. The high steel for pins, pintles and forgings was required in its natural state to stand bending through 180°, and closing up against itself without showing any crack or flaw on the outside of the bent portion.

The specifications for workmanship were as follows:

All plates, angles and shapes shall be carefully straightened at the shop before being put together; mill straightening will not be considered as meeting this requirement. For 1-in. rivets the diameter of the finished hole shall not be more than 1-16 in., and for ¾-in. rivets not more than 3-64 in. greater than the diameter of cold rivets. The heated rivets shall not drop into holes, but require a slight pressure to force them in. The relative size of rivet and rivet hole must be such as to meet this requirement. The material may be punched with holes ⅛ in. smaller than the sizes of the finished rivet holes. After the several pieces have been punched, they shall be assembled in the shops, and holes reamed to size while pieces are so assembled. After reaming, every hole shall be entirely smooth, showing that the reaming tool has everywhere touched the metal. A reamer shall be run over the outer edges of every hole, so as to remove the sharp edges, and make a fillet of at least 1-16 in. under each rivet head. After the reaming is completed, the several pieces shall be taken apart and cleaned. The surfaces in contact shall then be painted with a heavy coat of red lead and



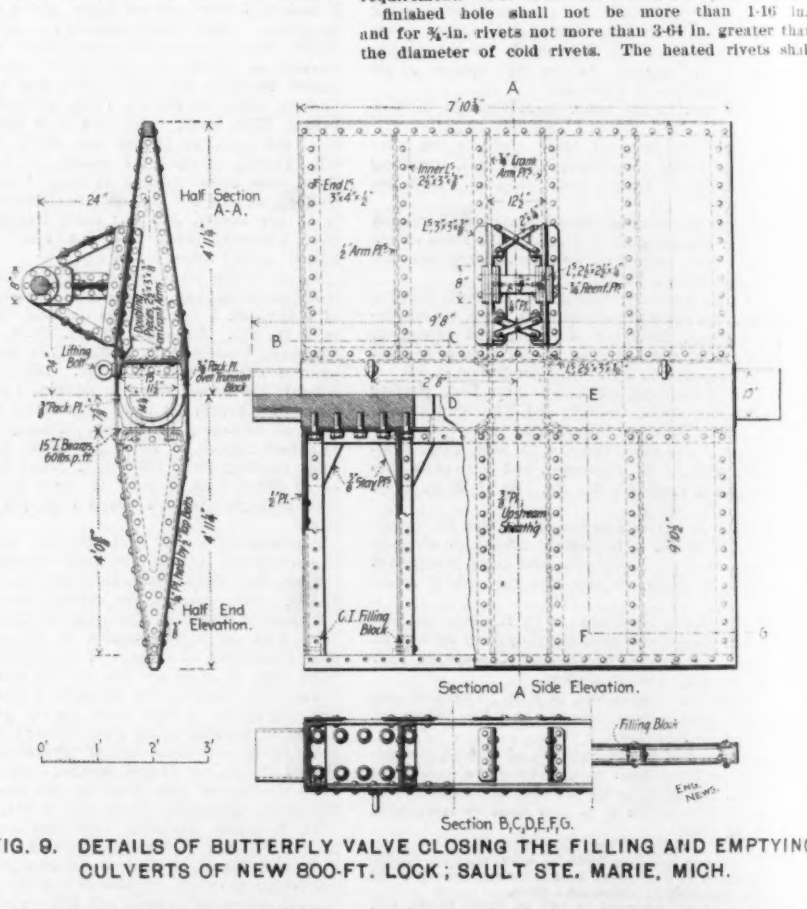


FIG. 9. DETAILS OF BUTTERFLY VALVE CLOSING THE FILLING AND EMPTYING CULVERTS OF NEW 800-FT. LOCK; SAULT STE. MARIE, MICH.

Fig. 10. Details of Frame of Butterfly Valve.

Fig. 8 on the inset sheet shows the south leaf of the lower lock gate, to which the south leaf of the intermediate gate is alike in all details. These gates are 43 ft. high. The upper lock and guard gates are 26 ft. 6 ins. high, and the lower guard gate is 25 ft. 6 ins. high. The only difference in the dimensions of the upper and lower guard gates and the upper lock gate is this 12 ins. of the curve of the inside face of the convex sheathing plates is 75 ft. 2.2 ins., and of the inside face of the concave sheathing plates is 79 ft. 8.83 ins. These general dimensions are common to all five pairs of gates.

raw linseed oil, the parts assembled while the paint is fresh, and riveted up. All rivets shall be regular in shape, with heads of a form acceptable to the agent of the United States and concentric with the axes of rivets. Rivets shall be driven by power wherever this is possible. Tightening by calking or recupping will not be allowed, except to prevent leakage of the air chambers. Angles connecting two plates at right angles shall be perfectly square and straight. The plate between the two angles shall never project beyond the surface which is to form the contact with the second plate, neither shall the former plate fall more than 1-16 in. below this surface, which shall be perfectly plain. In places where rivets cannot be driven, turned bolts may be substituted, which must be a driving fit. Bolts so put in shall have the nuts burred or riveted. The above requirements apply to all riveted work, including that to be done in the field.

All edges of plates, angles and shapes shall be carefully planed off, especially where butt joints occur. When lap joints require calking, the outside plate or angle, upon which the calking is done, shall be finished with a calking bevel. All pin-holes and holes for turned bolts shall be bored or drilled after all other work is completed. Pin and pintle holes shall be bored truly at right angles with the surfaces through which they pass, and shall be in exact positions as indicated on the drawings. The finishing cut of pin and pintle holes shall be taken with a sharp tool, and shall never be more than ⅛ in. Roughness shall be carefully avoided, and

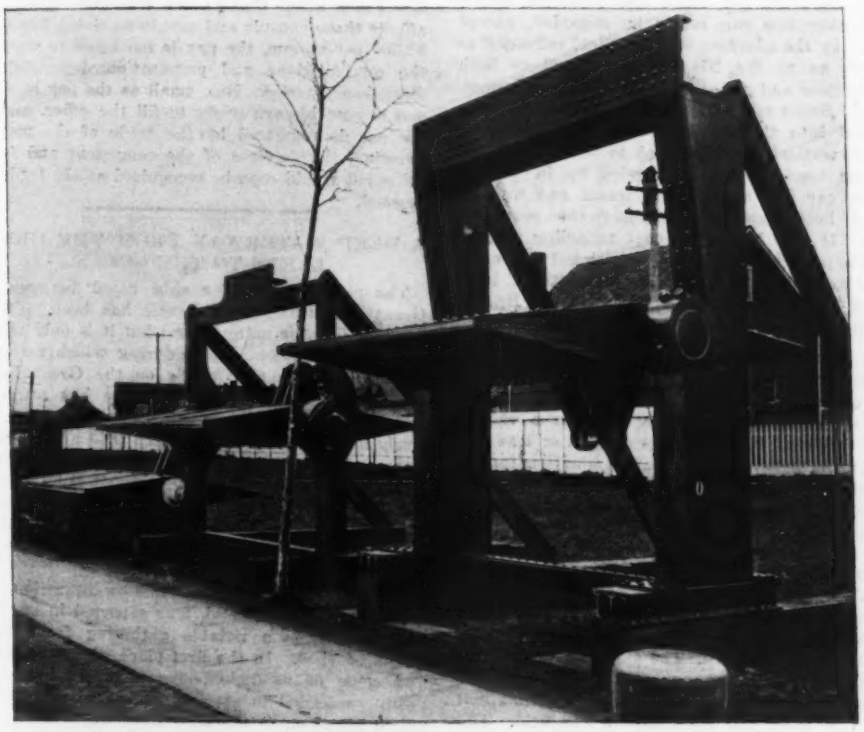


FIG. 11. VIEW OF BUTTERFLY VALVE FOR 800-FT. LOCK AND FOR LOCK OF 1881.

may be sufficient reason for rejecting such parts. All pins and pintles shall be accurately turned to a gage, shall be of exact cylindrical form, and those of same dimensions shall be interchangeable. Pin-holes of anchorage connections shall be bored to fit the pins, with a play of 1-25 in., or 1-56 in. all round. The holes for the pintles in the bed-plates shall be so bored as to make a driving fit. All surfaces designated on the drawings as finished shall be planed true and as smooth as an ordinary smooth-cut will make them. The ball bearings on the pintles of the bed-plates shall be truly hemispherical and polished. They must accurately fit the bronze bushings in the foot-plates. All screws shall have a truncated V thread, U. S. standard. Bolt heads and nuts shall all be hexagonal, of U. S. standard proportions. All forgings shall be made of high steel, and shall be annealed in a suitable annealing furnace, by heating them to a uniform dark red heat, and allowing them to cool slowly. All bearing surfaces, or surfaces to be connected with other pieces, shall be machine finished.

The specifications for inspection, painting, etc., were such as are usually required for first-class work.

Erection of Gates.—It was stipulated in the specifications that the quoin and miter posts should be shipped whole, and the body of the gate in such form and size of sections as were most convenient. The great weight of the quoin and miter posts, and the necessity of extreme accuracy in hanging the gates, required that the means for swinging the metal into place and holding it in position should be adequate for all possible conditions. A wooden truss span was first built transversely across the lock. The ends of this span were supported on wooden towers carried on trucks running on tracks laid along the canal wall. These tracks were laid far enough back from the edge of the wall to permit the material to be placed between them and the edge of the lock. On this span was a trolley, making the whole structure much like the ordinary traveling bridge crane used in machine shops in its construction and operation. With this traveler the quoin post was first lifted into position on the pivoted bearing, fastened to the masonry at the bottom of the gate recess, and then attached to the anchorages at the top. The body of the gate was then riveted to the quoin post in sections, and the miter post attached last. The total estimated weight of metal in the five gates was about 1,287 tons, and it was practically all handled by this traveler.

Valves.—Twelve butterfly valves are used for closing the filling and discharge culverts. Each of these valves is 8 ft. wide and 10 ft. high, and they are all constructed of steel. Each valve is set in a valve frame, which is also constructed of steel. Details of the valve and valve frame construction are shown in Figs. 9 and 10. Fig. 11 is a general view of one of the valves hung in its frame. To the left is shown one of the valves of the lock of 1881.

The construction is so clearly shown by the drawings as to make any detailed description unnecessary. The specifications for material were as follows:

Samples from forgings, steel plates, rods from which bolts are to be made, and rivet steel, will be required to bear a tensile stress of not less than 60,000 lbs., nor more than 70,000 lbs. per sq. in. of section, and to show an elastic limit of not less than 33,000 lbs. per sq. in. The reduction of area at the point of fracture shall not be less than 40% of the original area at that point, and the ultimate elongation not less than 20% of the original length of the parallel portion of the test sample. Samples taken from rolled shapes will be required to bear a tensile stress within 5,000 lbs. per sq. in. of the above, and to show an elastic limit, and percentages of reduction and elongation, in proportions thereto. Samples taken from plate and shape steel, and full-sized pieces of rod steel for bolts and rivets, shall bend cold through 180° around a diameter not greater than the least dimension of the sample taken, without sign of fracture, and rivets shall be subjected to such hammering and bending tests, both hot and cold, as to satisfy the U. S. agent in charge of their good quality.

The contractors for the gates and valves were the Detroit Bridge & Iron Works, of Detroit, Mich.

Anchorage Connection.—Referring to the general view of the gate, Fig. 8, it will be seen that the bottom of the quoin post on which the great gate turns rests on a hemispherical bearing 10 ins. in diameter, while its upper end carries an 8-in. pin passing through an eye-bar, which leads back to a radiating anchorage, of which the general design is shown in Fig. 12. The details of the connection between the top of the quoin post and the anchorage are shown in Fig. 13.

The reason for making the lines of anchor rods radiate from the anchor plate is easily understood when it is remembered that the enormous horizontal pull of the upper end of the quoin post, due to the great weight of the gate, must be sustained by the anchorage at every position of the gate. The general design of the anchorage is simple enough. Its interest lies in the enormous strains involved and the massive construction of the parts which are designed to sustain them.

The use of vitrified brick seems to be extending not only for street paving, but for paving floor spaces about manufacturing plants where great durability is required. The specification for the power plant of the Baltimore, Middle River & Sparrow's Point R. R., for which bids are now being received, requires the entire floor of the boiler room to be paved with vitrified brick laid on edge.

The International Navigation Co.'s steamship "St. Paul," on Oct. 4, made a trial run of 44.96 knots and return between Cape Ann, Mass., and Cape Porpoise, Me. The average speed made was 20½ knots per hour, and she thus earns the privilege of carrying the U. S. mail to Europe under the Mail Subsidy act, which requires 20 knots. The weather was generally favorable, but the ship's bottom was not clean. Her sister ship, the "St. Louis," made an average record of 22.2 knots per hour in a trial run in the English Channel. In the "St. Paul's" trial the average revolutions of the screws were 89.5 and 90 per minute on the two runs. The horse-power developed has not yet been made public.

Progress of the New York Rapid Transit Ry. will be slightly delayed by the refusal upon technical grounds of the General Term of the Supreme Court to appoint the three commissioners who are to decide whether or not the road shall be built upon the location and plans approved by the Rapid Transit Commission. In the absence of the consents of a majority of property owners along the routes laid down, the Supreme Court was to appoint the commissioners referred to. The court does not refuse the application upon its merits, but solely upon the ground that it has no jurisdiction in this case, as such jurisdiction is vested solely in the Appellate Division of the Supreme Court, which does not begin its existence until next January, under the provisions of the new state Constitution. Mr. William Steinway, of the Rapid Transit Commission, in discussing this imposed delay, says that there is no doubt about a report favorable to construction, as the great majority of property owners above 14th St. favor the proposed railway.

The Japanese contracts for water-pipe with Southern iron foundries, frequently referred to by the press within the last year, turn out untrue. The rumors had their basis in negotiations carried on by the Howard-Harrison Co., of Bessemer, Ala., with the authorities of Tokio for 12,000 tons of pipe. The bid of the American company was $1.50 per ton less than the bid of the Scotch firm which secured the contract, according to Mr. F. B. Nichols, a member of the firm; and the onerous conditions imposed by the Japanese alone prevented the contract from going to the United States. The London "Ironmonger," in discussing these Japanese pipe contracts, says that in 1893 Tokio wanted in all about 50,000 tons of water pipe, and the native capitalists attempted to start works in Japan for making pipe. But the price demanded was very much higher than foreign bids, and, though the municipal authorities accepted them from patriotic motives, by the time 1,500 tons were delivered it was evident that too much time would be consumed in waiting for the home product. In June, 1894, bids were again asked from foreign makers for 10,000 tons, and the contract went to a Belgian firm on a freight rate of $4.08 per ton from Antwerp to Japan, as against $6.69, the best freight offered by English shippers. In June, 1895, proposals were invited on another 10,000 tons, and McFarlane, Strang & Co., of Scotland, got the contract on as good shipping rates as the Belgians could obtain. The same firm supplied 700 tons of pipe to the Yokohama water-works.

ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

Published every Thursday at Tribune Building, New York.
Entered at the Post Office, New York, as Second Class Matter

D. McN. STAUFFER, CHARLES WHITING BAKER.....EDITORS.
WM. KENT, E. E. R. TRATMAN, M. N. BAKER, CHAS. S. HILL, A. B. GILBERT.....ASSOCIATE EDITORS.
CHAS. W. REINHARDT.....CHIEF DRAFTSMAN.

GEO. H. FROST, F. P. BURT.....BUSINESS MANAGERS.
ALFRED E KORNFELD, New York.....
F. A. PECKHAM, Chicago.....ADVERTISING REPRESENTATIVES

PUBLICATION OFFICE.....Tribune Building, New York.
CHICAGO OFFICE.....1636 The Monadnock.
LONDON AGENCIES: KEGAN PAUL, TRENCH, TRUBNER & Co. (Limited), Paternoster House, Charing Cross Road; SAMPSON LOW, MARSTON & Co. (Limited), St. Dunstan's House, Fetter Lane.

SUBSCRIPTION RATES: United States, Canada and Mexico, One Year, $5.00; 6 months, $2.50; 2 months, $1.00: single copies, 15 cents. To all other countries in the Postal Union, add $2.08 per annum (4 cents per number) to above prices for postage. No club rates allowed. Mailing addresses may be changed at will by sending both old and new address. We shall be obliged if subscribers who fail to receive their papers promptly will notify us without delay. The date when the subscription expires is on the address label on each paper: the change of this to a subsequent date is the only receipt sent, unless by special request.

ADVERTISING RATES: 20 cents per line agate measure. Want notices, special rates, see page 20. Rates for standing advertisements sent on request. Changes of standing advertisements must be in hand on Monday afternoon: new advertisements, Tuesday afternoon; transient advertisements by Wednesday noon.

The series of articles descriptive of the work on the Chicago Drainage Canal which were begun in our issue of May 15 are necessarily interrupted this week, through the fact that the detailed plans for the controlling works on Section 15, at the lower terminus of the canal (the only section we have not yet described), are not yet completed. We hope to be able to present the concluding articles of the series in two or three weeks. Doubtless many of our readers will be pleased to learn that the articles are to be reprinted separately, and the book will be ready about the close of the year. Aside from its value as a monograph describing in great detail one of the greatest public works ever carried out, the book will be found very useful for reference by reason of the detailed figures which it gives as to the cost of performing work of every class upon the canal.

It would be a remarkable outcome of Chicago's great drainage-canal enterprise if it should prove actually a remunerative investment to the city by reason of the water power which it will create. From the lower terminus of the canal at Lockport to the level of Lake Joliet there is a fall of nearly 75 ft. A simple calculation shows that if the ultimate drainage canal flow of 600,000 cu. ft. per minute were all utilized, over 60,000 HP. could be developed by the erection of suitable works, and a good market could be found for it in Chicago, as the distance is small enough to make electric transmission perfectly feasible. Chicago might then add to its claims to distinction the possession of a greater water-power at its doors than any other city of similar size in the world.

If cable traction is destined to be superseded by electric traction as a means of operating railways in city streets, as many engineers believe, it has nevertheless developed a field in which it promises to hold its own against all competitors. We refer to its use for moving cars on steep incline railways. On another page of this issue we present in tabular form a list of the cable incline railways of the world, with their length, location and principal features. It will be noted that a large proportion of these railways have been built expressly for the accommodation of tourists, and this is especially the case in the thrifty little republic of Switzerland, which relies for its income largely upon the revenue from tourists. As our table shows, there are in Switzerland nearly a score of cable railways up the mountain sides, built solely for tourists' patronage. In the United States our table gives a record of 24 inclines, five of which were built exclusively for tourist traffic, while most of the others are short inclines in Pittsburg and Cincinnati, carrying passengers, wagons and street cars. The total number of cable inclines of all countries is 55, aggregating about 28 miles in length, of which 30 inclines, aggregating 16 miles, have been built specially for tourist traffic. The most recently-built incline of this kind in the United States, the Prospect Mountain Ry., at Lake George, N. Y., was illustrated and described in our issue of Oct. 3.

Steep grade mountain railways may be divided into two classes: First, those operated by cables, and, second, those operated by locomotives on the rack-rail system in some form. The former may again be subdivided into (1) those which have the cables driven by a hoisting or winding plant, and (2) those in which a water-tank on the descending car overbalances the weight of the ascending car, no power plant being required. The steepest grade thus far employed on a cable railway is about 62 per cent., and it seems doubtful whether this can safely be exceeded, except possibly by the adoption of a "vertical railway," or elevator, as at the Niagara Gorge, where both cable inclines and elevators have been used. In fact, one bold Swiss mountaineer has proposed to drive a tunnel into the Jungfrau mountain and then drive a vertical shaft upward to the summit, so that the tourist could be carried up in a comfortable car and landed in a warm and well-appointed hotel established among the perpetual snows. It may be argued that tunneling upward would be particularly dangerous work, but this method was actually used in building a line 230 ft. long, with a grade of about 46 per cent. at Bristol, England.

The President and the State Department at Washington are to be heartily commended for the order of Sept. 20, directing that hereafter all consular and commercial agencies, within a certain salary list, shall be filled by promotion or transfer, based upon merit, and by the examination for fitness of new appointees. This means a political revolution, and would deprive a new administration of a long-established method of rewarding party service by consular appointment. But the defects of our present inefficient system have been recognized before by Congress, and as long ago as 1864 some attempt was made to remedy these defects by statutes providing for consular clerks and an examining board. The Department of State in 1866 issued an order requiring all applicants for consulates to present themselves for examination; under this order one examination was held. The present executive order is based upon the Civil Service Act of 1871, authorizing the President "to prescribe such regulations for the admission of persons into the civil service of the United States as may best promote the efficiency thereof, and to ascertain the fitness of each candidate in respect to age, health, character, knowledge and ability for the branch of service into which he seeks to enter." Under this Act the President may employ examining boards and establish regulations controlling the service, and it is hoped that in this manner our consular service can be rendered more efficient and generally useful in extending our trade.

The practice of foreign nations in this connection is in marked contrast with the methods heretofore controlling the appointment of consuls for the United States. Belgium, France, Switzerland and Germany have regularly equipped institutions for teaching all the intricacies of the consular service, especially in its relations to the extension of commerce; and from the graduates of these institutions the representatives in foreign countries are selected. The agents of these governments are compelled to be familiar with at least three foreign languages besides their mother tongue; they have a thorough commercial training; they are made acquainted with the government, physical conditions, chief products and trade relations of the countries into which they may be sent, and must have a competent knowledge of the diplomatic, judicial and commercial functions of consuls or commercial agents. They go into office in subordinate positions, but well equipped with the qualifications for rapidly proving useful to the government that sends them out; and as they gain the experience in this especial field that only long service can impart, they are rewarded by promotion as they become more and more useful. The representatives of the United States, on the other hand, usually lack all of these qualifications, and do not stay long enough in the service to acquire by time any useful knowledge of trade conditions and requirements. Their appointment is only a reward for some political service performed, and their tenure of office is brief. Is it any wonder, under these contrasting conditions, that the adroit, able and well-trained commercial agents of foreign countries should succeed where our consuls fail, and gather to their countries trade from sections of the world that properly belong quite as much to us? The experiment outlined by the President is well worth trying, and without some such reform we might as well, for all practical purposes, keep the majority of our consuls at home and save their pay. Some may argue that as this Executive order only affects those consuls and agents receiving less than $2,500 per annum, the pay is too small to warrant the qualifications and preparation demanded by European practice. But, small as the pay is, some one is now always ready to fill the office, and as the pay is regulated by the trade of the port in question, the services of the competent and faithful agent would soon be recognized as the trade increased.

A DEEP WATERWAY FROM THE GREAT LAKES TO THE OCEAN.

The project to build a ship canal between the Great Lakes and the Atlantic has been agitated more or less for many years; but it is only within the past half-dozen years, during which an enormous development of traffic on the Great Lakes has taken place, that the scheme has attracted widespread attention. A year ago those most actively interested in its promotion held a meeting at Toronto and organized the International Deep Waterways Association, the main, if not the only, object of which was to agitate for the construction of a waterway deep enough for the passage of ocean steamers between the Great Lakes and the Atlantic.

The annual meeting of this organization, recently held in Cleveland, was reported in our last issue, and was a notable gathering from many points of view. In the first place, the Association and some of its industrious members have certainly succeeded in attracting a large measure of public attention to the deep waterway scheme.

Among those in attendance at the convention were many men of wide influence, and delegations from the commercial organizations of the principal lake cities were especially notable. The list included men high in official position, Congressmen, Members of Parliament and Mayors of cities attended and took part in the proceedings.

But the most notable and remarkable thing about the whole proceedings was that, taken as a whole, the facts brought out at this convention tend very strongly to show the commercial impracticability of the very scheme which it is the avowed object of the Association to promote. That this is a very fortunate outcome of the convention's work may be conceded, but it is doubtless exceedingly bewildering to the red-hot deep-waterway enthusiasts to find that the Association which was organized to promote this scheme has been actually instrumental in bringing to general public attention the facts which show the scheme to be financially impracticable.

On the other hand, the bulk of the attendants at the convention were by no means committed to the deep waterway cause. Most of them were men in active business life, who had never given the enterprise any study further than to listen to the plausible claims made by its enthusiastic promoters. We can well believe that this class of men went to Cleveland expecting to learn some-

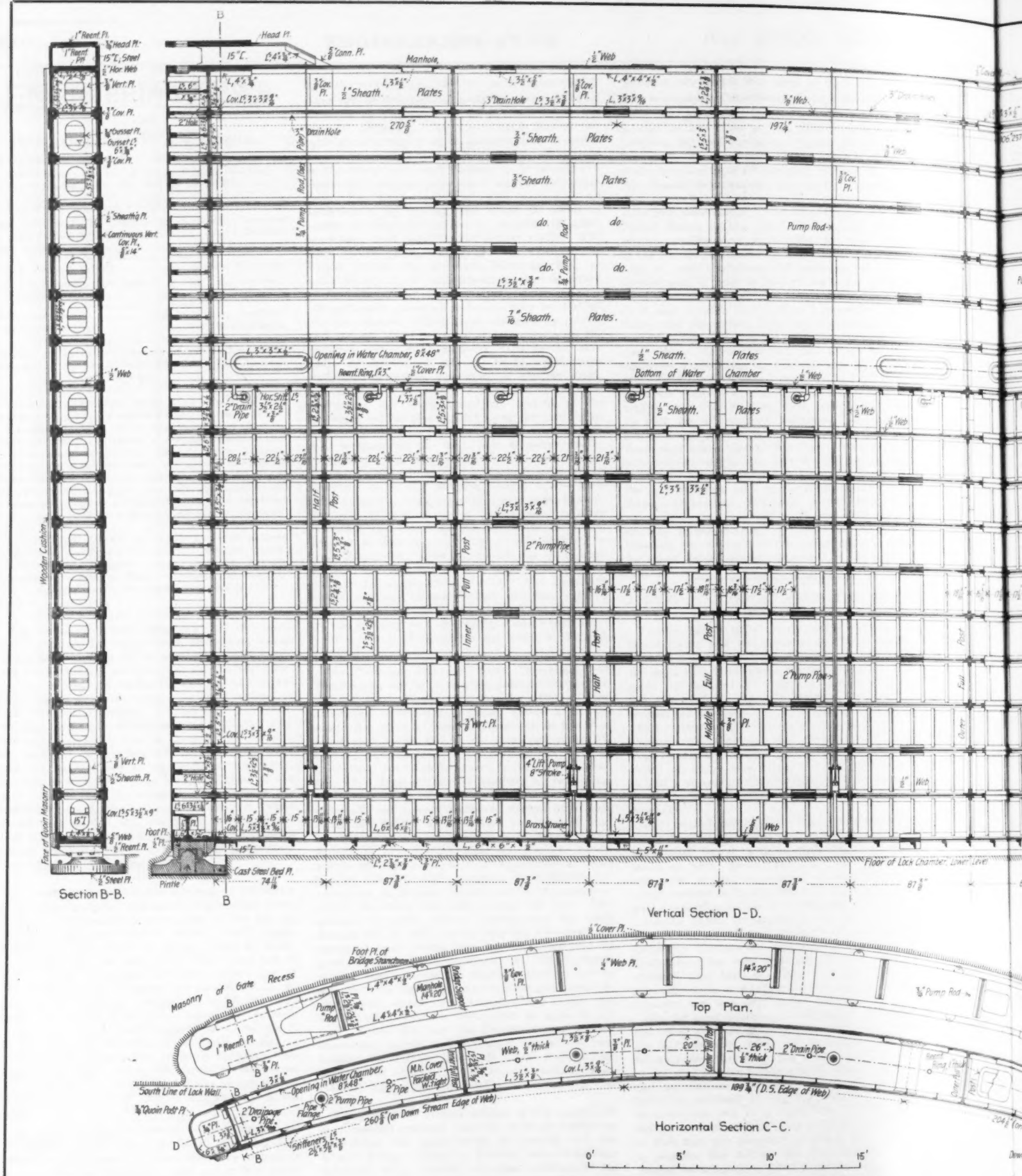


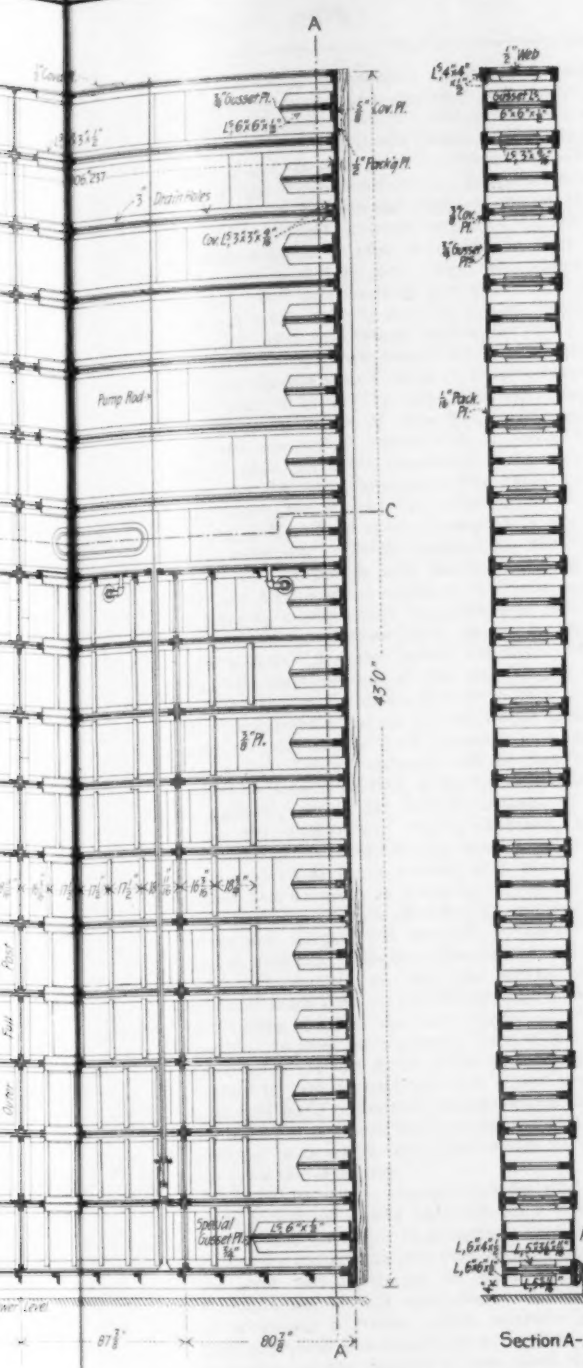
FIG. 8. SOUTH LEAF OF LOWER LOCK GATE.

STEEL LOCK GATES FOR THE UNITED STATES GOVERNME

Col. O. M. Poe,* U. S. Engineer Corps, Engineer in Charge of Navigation Improvements on the Grea

Detroit Bridge and Iron Works,

* Died October 2 1895.



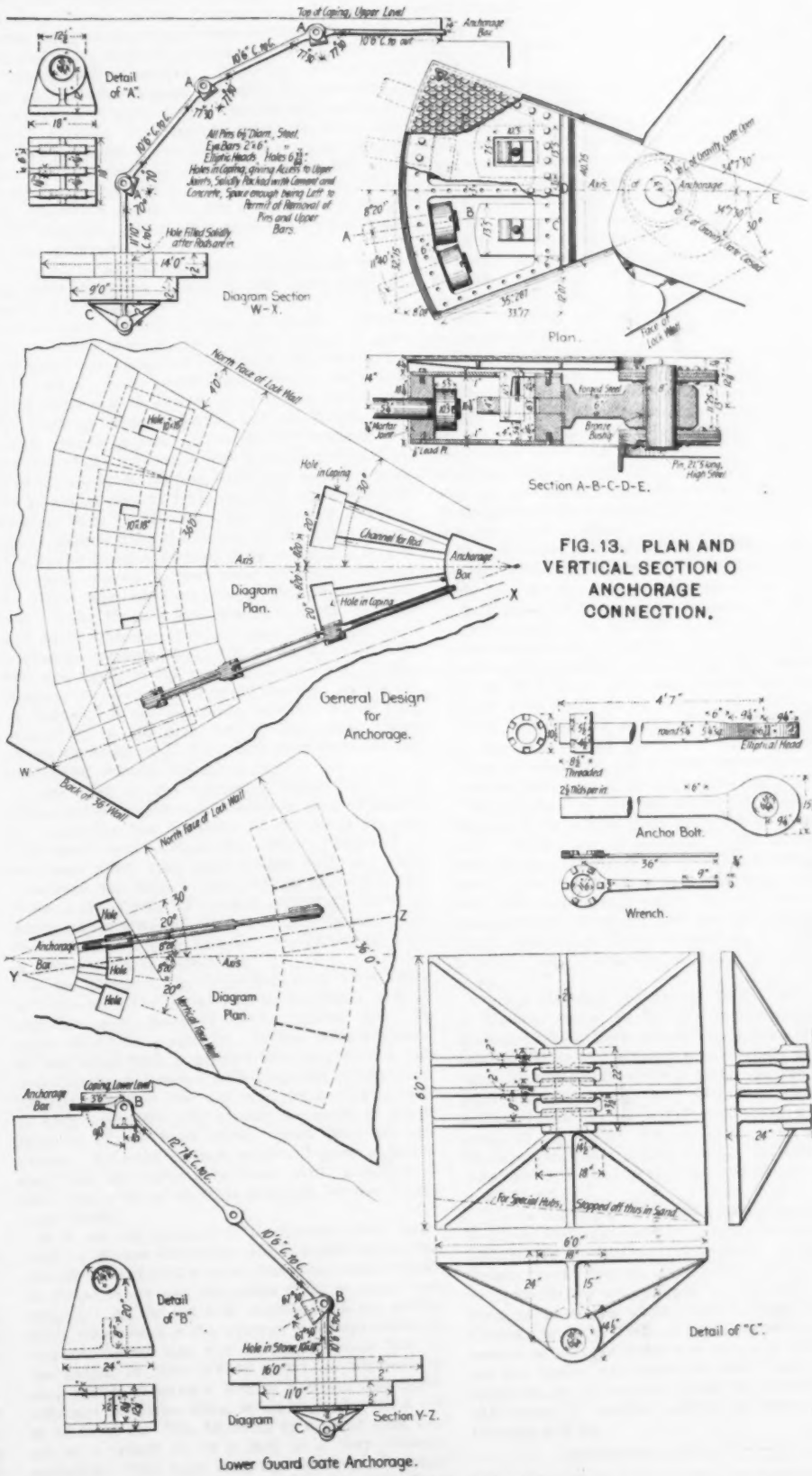
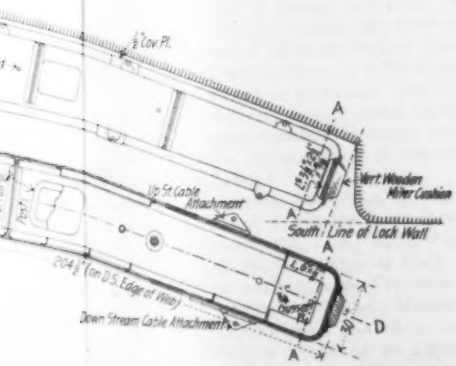

Top of Coping, Upper Level
Anchorage Box
Detail of "A".
All Pins 6½ Diam., Steel.
Eye Bars 2"x6", "
Elliptic Heads. Holes 6¾"
Holes in Coping, giving Access to Upper Joints, Solidly Packed with Cement and Concrete, Space enough being Left to Permit of Removal of Pins and Upper Bars.
Hole Filled Solidly after Rods are in.
Diagram Section W-X.
Plan.
Section A-B-C-D-E.
North Face of Lock Wall
Hole in Coping
Channel for Rod
Anchorage Box
Axis
Diagram Plan.
General Design for Anchorage.
Back of 36" Wall
Anchorage Bar
Coping Lower Level
Hole in Stone, 10x18"
Diagram
Section Y-Z.
Detail of "B"
Anchor Bolt.
Wrench.
Detail of "C".
For Special Holes, Stopped off thus in Spiral.

FIG. 13. PLAN AND VERTICAL SECTION O ANCHORAGE CONNECTION.



Lower Guard Gate Anchorage.

FIG. 12. GENERAL DESIGN OF ANCHORAGE SUSTAINING PULL OF QUOIN POST.

ERNMENT LOCK AT SAULT STE. MARIE, MICH.

the Great Lakes. E. S. Wheeler, U. S. Assistant Engineer in Charge of Work on St. Mary's River.

Works, Contractors for Gates and Valves.

thing concerning the project about which such a stir is being made—and departed with their expectations entirely satisfied. Nobody wants a ship canal built from the Great Lakes to the Atlantic unless it can, in some way or other, be made to pay. At the organization of the Deep Waterways Association at Toronto last year, no one, so far as we recall, thought it worth while to discuss the question whether a ship canal on the lines proposed was needed or not. That was taken for granted. But at Cleveland last month this question was taken up fully and fairly, and its discussion will make interesting reading for those who are asked to put their money into the enterprise, if it ever reaches such a stage as to invite capital.

We reprint in full in this issue the paper of Mr. Thos. C. Clarke, M. Am. Soc. C. E., read before the convention, which was, it seems to us, by all odds the most important there presented upon the ship-canal question. The facts and figures which Mr. Clarke has collected deserve the careful study of all those interested in the ship-canal enterprise. Briefly summed up, Mr. Clarke shows that freight is now handled between Buffalo and New York at a cost as low as it could be handled by a ship canal, supposing one were built at government expense and opened to shipping free of tolls. He also points out that with the moderate improvement of the Erie Canal, which is likely soon to be made, it is extremely probable that cheaply-built barges can be towed from lake ports to tidewater without breaking bulk, so that the actual cost of carriage will be less than it would be were it carried on by ocean steamers.

Another paper by Mr. Jos. R. Oldham, of Cleveland, the well-known marine architect, pointed out some of the reasons why present lake vessels are unsuited to ocean service, and ocean tramps would find no profit in going to the Great Lakes for cargoes. Captain McDougal, the builder of whaleback barges, put himself on record as in accord with Mr. Oldham's ideas, and declared that "Ocean transportation and lake service will not mix any more than oil and water will." We need not review further the proceedings of the convention, as they have already been abstracted in these columns; but as so much interest has been excited in this scheme, and not a few prominent engineers have committed themselves in its favor, we believe it is worth while to explain some of the principal facts which have to be considered in passing upon the enterprise.

It is by no means strange that the deep waterways movement should have secured a host of adherents and the favor of prominent men, for upon its surface the scheme is a very attractive one. To the west and northwest of lakes Superior and Michigan lies a vast agricultural region, capable of producing a greater grain product, probably, than any other equal area on the globe. A large proportion of the product of this great district of fertile farms and fields must find a market in Europe, and the selling price for the whole crop is fixed by the price for which the surplus can be sold in foreign markets. Manifestly, then, every cent by which the cost of transportation of a bushel of grain from a Dakota farm to the bin of a grain dealer in a European port can be reduced, means an additional cent to the grower of the crop on every bushel which he sells, provided the selling price remains the same, and that competition keeps the compensation of the middlemen at its present figure.

Again, the cities on the Great Lakes have enjoyed a wonderful prosperity during the past 10 years, due in no small degree to the development of the lake carrying trade. Though Chicago leads in point of size, Cleveland, Buffalo, Detroit, Milwaukee, Toronto, Duluth and a multitude of smaller cities have been developing at such a rate that it would be no strange matter if the heads of their real estate owners were somewhat turned by the rapid growth. Thus it is entirely natural that the proposal to "open the Great Lakes to the merchant marine of the world" and make the lake cities "ports of entry for the ships of all nations," should awaken great enthusiasm; and as men believe, as a rule, what agrees with their desires, a large proportion of the business men in the lake cities would probably be found to be believers in the ultimate success of the ship-canal enterprise.

But fine words butter no parsnips, and great engineering works are not built on enthusiasm. It is one thing to form a careless opinion of a subject and quite another to back up that opinion by the investment of money. Were the deep-waterway project ever so good a scheme, the lake cities interested in it could hardly furnish the capital it would require. As English investors have not yet got the taste of the Manchester Canal out of their mouth, and the Panama bubble has put French capital out of the question, it is difficult to say where the funds for the proposed ship canal could be found, even were it as promising a scheme as that at Nicaragua.

It seems to us that the essential fallacy on which the deep-waterway agitation has been bred is that a ship canal can take the place of open water as an avenue for the passage of vessels. If the Great Lakes were at an elevation of but a few feet above sea level, and connected with the ocean by a broad, deep, gently-flowing river, on which ships could sail as rapidly as they now do in the St. Clair or Detroit rivers, no one doubts that ocean vessels would ply regularly between the harbors of the lake cities and European ports. But it is a fallacy to suppose that any works within the power of man to build can even approximately produce such conditions. By whatever route a vessel passes from the ocean to the upper lakes, it must be lifted a vertical distance of 575 ft. If the route chosen is that most generally favored by those who have examined the question—the one via the Hudson and Mohawk rivers, Oswego and Lake Ontario—then a vessel must pass over a summit, descend about 150 ft. to Lake Ontario and rise again to the level of Lake Erie. These changes of level are a serious matter, not merely on account of the enormous expense which they necessitate in the first cost of any canal route, but in the delay and risk which they cause in the passage of vessels through a canal.

Some idea of the enormous dimensions of a lock suitable to pass ocean steamers may be gained by examining the drawings of the gates for the new 800-ft. lock at Sault Ste. Marie, published on our inset sheet this week. This will be, when completed, the largest canal lock in the world; yet it has a lift of only 18 ft., and only 21 ft. depth of water on its miter-sill, and it is only intended for the passage of lake vessels. Its estimated cost is a little short of $5,000,000.

If the ascent to the Lake Erie level were made by locks with the lift of that at the Sault, and no summits were required to be passed over, 32 locks would be necessary. It has been proposed to use locks with a greater lift, say, 40 ft., but every engineer familiar with hydraulic construction understands that the difficulty, expense and cost of such works are very greatly increased by every increase in the head under which they are operated. No locks of such combined great capacity and high lift have ever been built, although a lock with a lift of 45 ft. is proposed for the Nicaragua Canal.

It is not our purpose at the present time, however, to discuss difficulties which would attend the construction of such a canal, but those which would be found in its use, supposing it to be once constructed. At the old lock at present in use at the Sault, 40 minutes is the average time required for a lockage. Some idea can be formed from this of the length of time which would be required to pass vessels through a lock of a width and depth sufficient for large ocean steamers, and with a lift of 40 ft. or so. The handling of a great steel vessel at a wharf or in a lock is a very delicate operation. The huge bulk has such an enormous momentum that even though it touches a wall or gate at a rate of motion hardly perceptible, destruction is very likely to result.

As our readers know, accidents in the operation of canal locks are by no means unknown. Suppost a ship canal were open to the Great Lakes and ocean steamers were passing back and forth through it. Any accident to any one of the chain of 20 to 50 locks between the lakes and the ocean which would put it out of service would bottle up in the lakes the fleet of grain carriers until the damage could be repaired. With such a long chain of locks operating under a high head and handling vessels of great burden, a considerable percentage of accidents would be certain to occur, and it might easily happen that weeks or even months would be required to make good a serious accident.

But the question of locks, serious as it is, is by no means the most important in the problem. Mr. Clarke, in his able paper, has called attention to the very low speed at which vessels can be moved in a narrow channel. The advocates of ship canals have made us familiar with the very low rates per ton-mile at which freight is carried in ocean vessels, but when a vessel has to cut down its speed to one-third or one-fourth of its ocean speed, as would be necessary in a ship canal, it is manifest that the cost of carriage per ton-mile is trebled or quadrupled, for interest, insurance and seaman's wages are based on time and not on miles traversed.

There is, indeed, one possible ship canal route to the Great Lakes by which the difficulty just mentioned would be reduced to a minimum. That is the Ottawa River route, by which the total length of canal required is only about 27 miles, the rest being river and lake navigation. The route has the further advantage that the distance from the grain-shipping ports on lakes Superior and Michigan to Europe would be several hundred miles less than by any other.

It is possible that a ship canal might be built on this route which would be a commercial success; but, on the other hand, the ascent through a long chain of locks would be necessary here as on other routes; the difficulties and obstacles which might attend the work can only be conjectured, no survey of the line ever having been made, and the great volume of trade which has so long sought New York as an export port could be diverted from it with great difficulty. The bulk of the products of the Northwest are after all consumed in the East, and the export trade naturally tends to follow the same channel as the domestic.

The question of first importance is, What will a ship canal save over other methods of transportation? If the cost of handling grain between the ports at the eastern end of the lakes and tidewater were what it was 20 years ago, there might be hope for a ship-canal enterprise; but the cost of transportation both by rail and by the existing barge canals has been reduced to a figure surprisingly small, and the tendency is still downward.

During the past season the New York Central & Hudson River R. R. has carried grain from Buffalo to New York at rates as low as 3 cts. per bushel. It is not necessary to assume that such rates involve a loss to the railway company. With modern large-capacity cars and heavy locomotives a single train carries 40,000 bushels of grain and earns $1,200 on its trip, or an average of about $2.75 per train-mile. The average earnings of the New York Central per freight train-mile in 1893 were $1.92.

It is to the improvement of existing barge canals, however, that engineers are looking with most confidence for a further considerable reduction in freight rates from the lakes to the seaboard. When so conservative an engineer as Mr. Clarke looks forward to seeing grain carried from Duluth or Chicago to New York, without breaking bulk, in barges so cheaply built and operated that 2 to 3 cts. per bushel will cover the entire cost of transportation, it is certainly time for advocates of a ship canal to explain wherein its commercial advantage will lie.

LETTERS TO THE EDITOR.

CONCERNING NICARAGUA CANAL ROUTES.

Sir: In your issue of Aug. 29 Mr. R. M. Lawter takes too much for granted in implying from my letter that I propose a location for the Nicaragua Canal on the south bank of the San Juan. I have nowhere proposed any such scheme, nor have I ever laid down so far, in public, what the features of my location are, though quite ready to do so, whenever the time arrives, in my opinion. The only points which can fairly be inferred from my letters so far are: 1. That I propose the Colorado mouth as the Atlantic terminus

instead of Greytown, so as to get to windward of the fearful sand drift on the Greytown bar. 2. That I would utilize the San Juan River to some point considerably below Ochoa, so as to avoid the useless Eastern divide cut.

Mr. Lawter names a lot of rivers which he crossed between San Carlos and Colorado mouth while hunting a railroad location; and his surveys, I have no doubt, would give some very valuable information bearing on the canal question. But his statements are very vague: "Going south from the Colorado," etc. Do those rivers empty into the San Juan between San Carlos and the Serapiqui? In that case, alone, would they have any interest for me? Also, at what point did Mr. Lawter cross the Serapiqui with his railroad line—i. e., how far above its junction with the San Juan? Flood levels 26 ft. above normal at that point, if true, would certainly surprise the advocates of Mr. Menocal's location in the effect that they would have on his embankments in the San Francisco valley, etc., and think of the fate of the poor little Costa Rican custom house on the hill at the mouth of the Serapiqui. The fact is, Mr. Lawter has surveyed for a railway line entirely outside of the catchment area of the San Juan River, between the Rivers San Carlos and Serapiqui; he has crossed the Serapiqui far up in Costa Rica, where its channel is well known to run into the mountains and be subject to any kind of flood level at certain points. He fails to say where the other rivers he mentions go to, and assumes he knows all about the line I have not laid down, for which I merely suggest, for safety, that more surveys should be made; in other words, he builds up a man of straw for the sole purpose of valiantly knocking him down.

If Mr. Lawter can really answer this question he will have shed some valuable light on the canal problem. Is it, or is it not, possible to dam the San Juan River at any point lower than the proposed Ochoa dam? And if at any point, say, at Serapiqui, for example, raising the San Juan 10, 20, 30 or 40 ft. with a dam, could the dam be connected with the Eastern divide or ridge line of the Serapiqui, or any of the other rivers he may have in mind, so as to enclose its waters without excessive cost, and utilize the San Juan between that point and Ochoa, giving, say, two or three dams in the San Juan River, if necessary, instead of in the San Francisco and Deseado Valley?

Please observe in this, I am by no means laying down a line which I propose. I am only showing Mr. Lawter that the Nicaragua Canal was evidently not included in his railway survey, and I repeat that no plan for a canal through Nicaragua should be accepted as final without a survey of the south bank of the San Juan down to the mouth of the Colorado.

I am as ready as any one else to acknowledge Mr. Menocal's location for a Nicaragua Canal the best and only one when all other proposed lines have been proved impossible by demonstration of actual surveys, but if I ever have to admit that much, then will I also hold the opinion that Panama, as it stands, is far better than that, and we had better let Nicaragua alone altogether. In my opinion, Mr. Menocal's form of dams and embankments are far worse than Gamboa, since Mr. Menocal's own figures, in the 1875 report of the U. S. expedition to Panama under Commander Lull, declare the Panama Canal to be feasible as a lock canal, at a cost of $94,511,360. Certainly, some of the work done there and the plant accumulated should reduce that figure now, even though the location differs very widely. As I have before stated, however, I do not place implicit confidence in Mr. Menocal's figures, either for Nicaragua or Panama, and I am convinced that a better line can be secured there than at Panama, but the line I have not laid down yet, Mr. Lawter to the contrary notwithstanding.

Yours very truly, J. T. Ford,
Assoc. M. Inst. C. E., Ch. Engr. & Gen. Man. C. M. R.R.
Cartagena, Sept. 20, 1895.

THE ECONOMIC DEPTHS OF PLATE GIRDERS.

Sir: I note in your issue of Sept. 12 a formula, ascribed to Professor Johnson, for finding the economic depth of plate girders. I have been using for some years a formula which seems to me preferable to that there given, in that my formula varies with the number of cover plates used. It is as follows:

Let m = bending moment at center in foot-pounds.
" S = flange strain per square inch of gross area.
" T = average thickness of web.
" G = a constant, varying with number of cover plates.
" x = economic depth center to center of gravity of flanges in inches.
Also let D = ratio of cover plate area at center to total flange area.
Also let E = most economic value for D.
And " n_1 = number of cover plates used.

Then $$x = \sqrt{\frac{G\,m}{S\,T}} \text{ and } E = \frac{4\,n^2}{9\,(1+\sqrt{2}+\sqrt{3}+\ldots+\sqrt{n})^2}. \quad (1)$$

For girder with no cover plates G = 24 E = 0
" " " 1 " plate G = 20.44 E = .444+
" " " 2 " plates G = 19.13 E = .6004+
" " " 3 " " G = 18.41 E = .698+
" " " 4 " " G = 17.97 E = .7535+

If the ratio of cover-plate area to total flange area varies from the economic ratio "E," the economic depth is increased, but the increase is very slight within the probable limits of variation.

Professor Johnson's formula agrees closely with my formula for two cover plates. The reason is, that he assumes the average flange area to be 0.8 of the middle area, and this is about right when two cover plates are used to make up 0.6 of the total flange area.

The general formula from which formula (1) is derived is

$$x = \sqrt{\frac{24\,m}{S\,T}\left(1 - D + \frac{D\sqrt{D}}{n\sqrt{n}}(1+\sqrt{2}+\sqrt{3}\ldots+\sqrt{n})\right)} \quad (2)$$

This formula is perfectly general, with the exception that all the plates are assumed to have the same area.

It is to be noted that the quantity T is not the actual thickness of web, even when this is uniform throughout the length of girder, but is to be found as follows: All web material, including end angles, stiffener angles, filler plates, etc., is supposed to be concentrated into one plate of uniform thickness, the depth of which plate is the depth center to center of gravity of the flanges. T is the thickness of this imaginary plate. The writer ordinarily assumes the imaginary plate to be 1-16 in. thicker than the actual plate. It is not difficult to figure the excess accurately when desirable. This, of course, applies to Professor Johnson's formula as well.

I have omitted the mathematical work leading up to the general formula (2), but will furnish the same to any one desiring it. Very truly,

M. J. Patterson.
No. 1, Good Block, Denver, Colo., Sept. 19, 1895.

NOTES AND QUERIES.

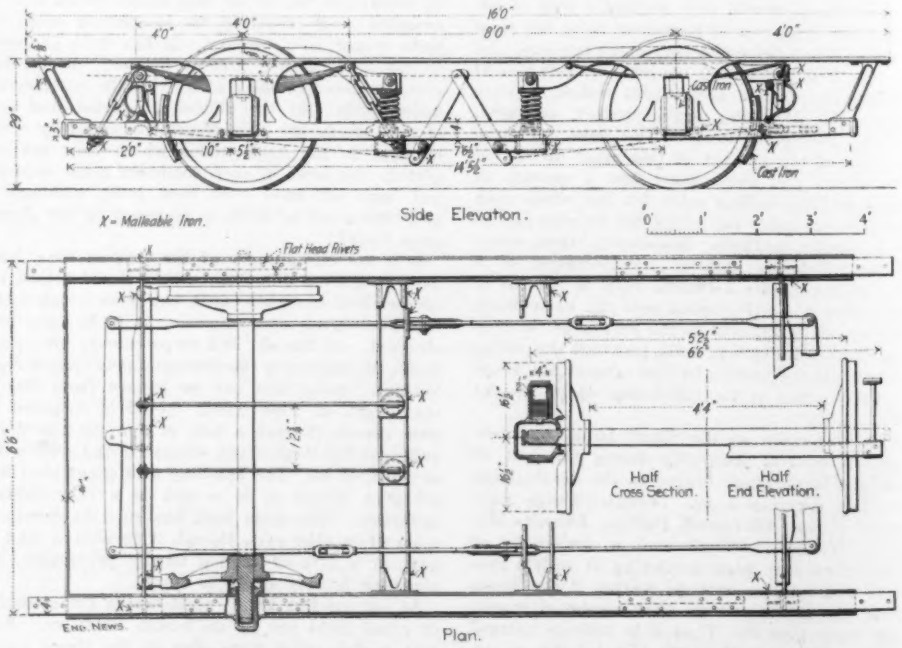
J. Q. S. wishes to know what a "Glaneur suction" is, and where it can be obtained. He believes it to be an apparatus designed to raise water carrying large amounts of sediment or other solid matter, but desires particulars.

J. Y. W. asks: "Is it considered entirely certain by scientific teachers that the adhesion of a locomotive varies directly with the weight on the drivers, without regard to the size of the drivers, other things being equal?" It is entirely certain, as a practical matter; theoretically it is possible that the fact that a wheel of very large diameter presents a larger surface to the rail than a wheel of very small diameter, might make a trifling difference.

RADIAL TRUCK FOR STREET CARS.

Four-wheel street cars usually suffer from a longitudinal pitching or lurching motion, due to the length of the car body and the shortness of the wheelbase. As the wheelbase is rigid and the car has to traverse sharp curves, the wheelbase cannot well be increased, except on cars long enough to be mounted on two four-wheel trucks. We illustrate this week a radial and non-oscillating truck, designed by Mr. D. F. Henry, President of the Federal St. & Pleasant Valley Passenger Ry., of Pittsburg, Pa., and which is said by Mr. David H. McDonald, the Master Mechanic (to whom we are indebted for blueprints), to fully meet the requirements of hard service due to narrow streets, sharp curves and steep grades on this road. The truck is made in different sizes, with a wheelbase of 7 to 10 ft.

The truck has plate frames with malleable iron braces, and the whole weight of the car body and truck is carried by four plate springs over the axle boxes, the ends of these springs being anchored to the underside of the frame by links, which thus allow the springs to move longitudinally on the truck. The car body rests on the four curved bars, the outer ends of which are attached by hangers to a transverse bar carried in the frames, while the inner ends are seated on coiled springs carried on the cross bars of the frame. The journal boxes are so made as to allow the wheels and axles to conform to the radius of the sharpest curves, and this arrangement has been found to result in a decided reduction in wear of wheels and rails. A notable feature of the design is the extent to which malleable iron is used for connections, filling pieces, brackets, etc.



D. F. HENRY'S RADIAL AND NON-OSCILLATING TRUCK FOR STREET CARS.

The twin-screw steel armored cruiser "Brooklyn" was launched at the Cramps' ship yard, in Philadelphia, on Oct. 2. The keel of the "Brooklyn" was laid in 1893, and, according to the contract, she is 400 ft. 6 ins. long on the load-line, 64 ft. beam, and 24 ft. mean draft. Her displacement is 9,153 tons, and the maximum I. HP. is 16,000. Her contract speed is 20 knots, and her coal capacity is 1,753 tons, giving her a steaming radius of 1,758 knots at full speed, and 6,088 knots at a 10-knot speed. The contract price was $2,986,000, and she was to be completed by Feb. 11, 1896. A premium of $50,000 for every quarter knot over 20 knots accompanies the contract. The four engines are of the vertical triple-expansion type, and the seven steel boilers, in three compartments, are of the horizontal, return-flue type, designed to work under 160 lbs. pressure, with 33,346 sq. ft. of grate surface. The vitals of the ship are protected by a belt of 3-in. Harveyized steel, with a protective deck above, decreasing from 6 ins. to 3 in., and above this deck are the coal bunkers. Her main battery consists of eight 8-in. guns, mounted in 4 turrets, with 5½-in. armor, and 12 5-in. guns, disposed for an all-around fire, and placed behind 4-in. shields. The secondary battery includes twelve 6-pdr. and four 1-pdr. rapid-fire guns and four Gatling guns. The barbettes have 8 and 4-in. armor. The "Brooklyn" was designed throughout by the Bureaus of Steam Engineering, Construction and Repair, and Ordnance.

AS SEEN BY AN ENGINEER.

(Editorial Correspondence.)

Pittsburg's Iron and Steel Industry.

Pittsburg is enjoying a boom in its iron and steel works similar to the one that it experienced in 1879, but with the important difference that the works have now a far greater reserve capacity for production, and are able to meet almost any possible demand. Prices have advanced from 50 to 75% above those prevailing during the darkest days of the depression at the beginning of the year, and are likely to be maintained about the present figures for some months to come; so that, with the heaviest tonnage ever known, the prospective profits of the manufacturers bid fair to make up for the two years of bad business.

Allegheny County, including Pittsburg and its suburbs, is now the most important iron-producing center of the world. Starting from the junction of the Allegheny and Monongahela rivers, the iron and steel works are strung along both sides of the rivers, for a distance of five miles up the Allegheny to Sharpsburg, 15 miles up the Monongahela to McKeesport, and two miles down the Ohio River to Wood's Run. It would take a month to visit all of these works, so, with only three days at his disposal, your correspondent confined his visits to a few of the most famous works. In the last 20 years a complete revolution has taken place in the manufacture of iron and steel. Before 1872 no blast furnace in the world had made as much as 500 tons of pig iron in a week. Now that product has been reached in a day. Since that date both the Bessemer and the open-hearth steel processes have been introduced, and in the methods of handling the material in both processes such advances have been continually made that a new mill usually becomes obsolete in about five years. Nearly all of the improvements have been the work of the mechanical engineer, whose one object has been to design machinery that would handle the product almost automatically, without the use of manual labor, and to handle it so quickly that a continuous procession of heated ingots and blooms passes through the rolls without any waiting for heats or other delays. The utmost resources of steam, hydraulic pressure, electricity and ponderous machinery have been brought into service. The engines, rolls, cranes, charging machinery, etc., are all of the heaviest description, designed especially to avoid breakage or delays from any cause. Economy of time and of labor are the most important considerations, while economy of steam is but little thought of. Boilers are run with chimneys almost red hot, and engines are usually not compounded. In some cases, however, economy of steam is beginning to be considered; water-tube boilers with automatic stokers have been adopted to some extent, and a few compound engines have been introduced. The use of electric power is rapidly increasing, and probably the next great improvement in steel works will be the concentration of the boilers and engines in one part of the works, both being of the most economical types, and the transmission of power to different points by electricity.

The experience of Pittsburg during the depression of trade seems to prove that it will remain the leading iron and steel center. While the total iron production of the country fell off about one-third from 1892 to 1894, Pittsburg produced far more than its share, its furnaces and mills running almost constantly, while those of other parts of the country were shut down. During the last five years the increased capacity of the iron and steel works of Pittsburg has been greater than that of all the Southern states put together. For trade tributary to the Great Lakes, Cleveland and Chicago are Pittsburg's most prominent rivals, but for the far wider market of the central part of the country, and for all the trade that can be reached by the Ohio and Mississippi rivers, Pittsburg's position is impregnable.

The Edgar Thomson Steel Works.

These works, the earliest built of the Carnegie works, contain the largest blast furnace plant and the largest mill for rolling steel rails in the United States. The blast furnace plant has not been enlarged since 1890. It contains nine blast furnaces, one of which is run on spiegeleisen, the others on Bessemer pig for the converters, and on basic pig for the open-hearth furnaces at Homestead. Two new blowing engines, built by the Southwark Foundry, of Philadelphia, are being erected at the newest pair of furnaces, known as H and I.

The metal for the converters is taken in ladles to two "mixers" or reservoirs, of about 150 tons capacity each, situated near the furnaces, and from them it is taken as required in large ladles to the converter plant, a distance of about a quarter of a mile. The converter plant has recently been altered from three 10-ton to four 15-ton vessels. These are placed in a row on an elevated platform, on one side of which runs the track by which the pig metal is brought to the vessels, and on the other side is a track on which is brought the ladle containing the melted spiegeleisen. The old-style casting pit is done away with, and instead is used the system of ingot molds standing on cars. Two molds are on each car, and a train of these cars is brought by a locomotive to the edge of a platform opposite the converters, along which it is pushed by hydraulic pushers. Each pair of converters has a ladle crane serving it. When a heat has been poured into a ladle, the crane lifts it and deposits it on a resting place in front of the casting platform, and then takes a second ladle, from which the steel has just been poured into the ingot molds, and carries it to the position in front of the adjoining converter. The writer timed a heat in one of the converters, and it took between 17 and 18 minutes from the time the blast was turned on until it was turned on again for the next heat. The time of blowing was 12 minutes, and the rest of the time was occupied in turning the converter, pouring the steel into the ladle, dumping out the slag, turning it up and through an angle of 270° to receive the new charge of pig metal, and back to the vertical position. The spiegeleisen was not poured into the converter, as was the old practice, but was poured into the ladle at the same time that the steel was poured. Only two out of the four converters are used at a time, the other two being kept in reserve.

The steel being poured into the ingot molds standing on the cars, the latter are drawn by a locomotive in the direction of the blooming mill. A long train of these cars is in progress between the two houses, so that when the ingots arrive at the mill they are cool enough to be stripped from the molds. This operation is done by a machine worked by hydraulic power. From this machine an electric traveling crane lifts them and deposits them while still in a vertical position in the heating furnaces, or pits, where their temperature is equalized, the inside solidifying while the outside becomes hotter. So rapid were the motions of this crane that three ingots were deposited in the pits in one minute.

Another electric crane lifts the heated ingots out of the pits and places them on a car, which is rapidly transferred to the feeding rollers of the blooming mill. A small hydraulic press tips the car so that the ingot falls on the feeding rollers, and it is then taken to the three-high blooming mill, where, in about a minute, it is rolled into a long, 8-in. square bloom. This blooming mill is the same as it was 10 years ago; in fact, it is but little different, except in size and strength, from the three-high blooming mill, with driven feeding tables, invented by the late George Fritz, about 25 years ago. A hydraulic shear cuts off the ends of the bloom, and cuts it into two pieces. Both pieces are then rapidly carried on driven rollers to the rail mill.

The rail mill remains practically the same in arrangement as when it was built by the late Capt. Wm. R. Jones. It contains a long row of heating furnaces, with doors on both sides. On the charging side a traveling carriage pulled by a wire rope, and containing rollers, carries the blooms to the door of a furnace, which is ready to receive them. A locomotive charging machine, which travels on a track parallel to the carrier track, instantly pushes them into the furnace. On the other side of the furnace is a similar rope-driven carriage, and two locomotive drawing machines, each one serving one-half of the furnaces. The locomotive and carriage being opposite the door of a furnace, the latter is opened, the drawing bar, with a gripping claw on its end, is inserted and pulls out the bloom onto the carriage, which is instantly drawn by the wire rope to the feeding rollers of the rail mill. The rapidity of the drawing operation is extraordinary. From the time of drawing one bloom to that of drawing another is only from 25 to 40 seconds, the difference being due to the varying distances traveled by the carriage from the furnace doors to the feeding table of the rolls.

From the feeding rolls the bloom passes rapidly to the first section of the mill, a three-high stand, in which it receives five passes. Before these five passes are finished, the following bloom has entered the first pass, so that two blooms are being rolled in this stand of rolls at the same time. From these rolls other feeding rollers carry it to the second stand, also three-high, in which it receives five more passes. It is then carried further in the same direction to the third stand, two-high, in which it receives only one pass. On leaving this pass a revolving die stamps the name 'Carnegie Steel Co." at several places on the web, and it then passes in front of a gang of three or four saws, which cut it up to make two or three rails, according to the weight and size. During the writer's visit two 33-ft. rails were being made from each bloom. The time between the passage of one pair of rails and the following pair averaged only 40 seconds. From the saws the rails are taken by driven rollers to the cooling beds, and thence to a long shed in which there are a great number of straightening presses and drills. They are then slid out to the shipping tables, from which they are slid into the cars for shipment. The whole mill is certainly a wonder of mechanical skill, and it would seem as if further progress in rail rolling would be almost impossible.

The Homestead Steel Works.

These works, made famous by the great strike and riot three years ago, are situated on the right bank of the Monongahela, about six miles above Pittsburg. Five years ago the writer visited them on the occasion of the meeting of the British Iron and Steel Institute and the Deutscher Eisenhuettenleute Verein, and they were then a notable works, having the largest plant of open-hearth steel furnaces in America, the largest roll train for cogging or blooming heavy ingots, and the largest mill for making structural shapes. Since that date great changes have been made in the works, several millions of dollars having been spent in their enlargement and alteration. One of the improvements is the new armor-plate department, containing a 10,000-ton hydraulic forging press, built by Sir Joseph Whitworth & Co., of Manchester; a smaller press for bending, with the necessary furnaces for heating the ingots; a great machine shop for finishing the plates; a series of furnaces for cementing, or "Harveyizing," the plates, and oil and water baths for tempering them. The government contracts for armor plate are now nearly completed, only about 700 tons remaining to be finished, and but little work is now being done in the armor plate plant. The latest improvement in armor plate making is the re-forging after Harveyizing, with the result that a 14-in. re-forged and tempered nickel-steel plate is equal to an ordinary Harveyized nickel steel plate of 17 ins.

A new mill for rolling beams up to 24 ins. in depth is now in full operation, and is a remarkable piece of machinery. It takes an ingot of about 20 × 30 ins. in cross-section, reduces it by a two-high reversing mill to a long bloom, carries this on rollers to a hot saw, where the ends are sawed off and it is cut into two lengths. One of these lengths is delayed on the rollers under a long oven, heated by natural gas, which keeps it warm while the other length proceeds to the three-high finishing mill, which contains four stands of rolls and a locomotive crane on each side to transfer the beam from one stand to the other. The beam emerges from the finishing pass about 110 ft. long, and another hot saw cuts off its ends and cuts into lengths as desired. A carrier of driven rollers about 600 ft. in length takes the

beams out of the storage yard, which is several acres in extent. This yard is served by a great number of electric-driven overhead traveling cranes, which completely cover the yard in parallel rows, so that a beam can be placed with the utmost convenience in any part of the yard. From the yard they are brought back as needed, by means of the traveling cranes and another set of driven rollers, into the mill, where they are cut to exact length cold by an immense cold saw. This saw is a steel plate 84 ins. in diameter and 5-16 in. thick, driven at 1,500 revolutions per minute by a 36-in. belt from a countershaft, which latter is driven by another belt from a 500-HP. Porter-Allen engine. The velocity of the circumference of the saw is over six miles per minute. So great is its effectiveness that it will saw through a 24-in. beam in eight seconds, and it is able to saw to length the whole product of the mill. The beams as they leave the finishing pass of the rolling mill, and after cooling, are perfectly straight in the plane of their flanges, but they are apt to have slight bends sidewise, and these are straightened in a straightening press driven by an electric motor. This press contains a series of vertical pressing dies, which are so arranged that they can be instantly changed in position by a hydraulic cylinder, so that the pressure of the dies can be caused to slightly curve the beam towards either the right or the left, as may be necessary to straighten it. So rapid is the action of this press, that two men operating it are able to straighten all the beams that are made by the mill.

The ingots which form the raw material of all the several rolling mills and the armor-plate press of the Homestead works are made by the Bessemer plant, containing two converters and the open-hearth plant containing 16 furnaces in two houses, with eight furnaces each. The open-hearth furnaces all use the basic process. In the No. 2, or most recent of these open-hearth houses, the furnaces are charged by machinery. Cast iron semi-cylindrical boxes, carried on cars, and containing, perhaps, half a ton each, are loaded in the pig and scrap yard, and taken by locomotives to the charging doors of the furnaces. The boxes are then lifted by a locomotive-charging apparatus, pushed into the charging doors, turned 189°, dumping the load into the furnace, and withdrawn. In the No. 2 house four additional furnaces of 40 tons capacity each are now being erected, two of them being nearly finished. The older furnaces have a capacity of 35 tons each, and the 16 furnaces have made as much as 1,300 tons in a day of 24 hours. On an average 2½ heats are made in each furnace per day.

The National Tube Works Co.

The works of this company are situated at McKeesport, 15 miles east of Pittsburg, on the Monongahela River. They are probably the largest tube works in the world, and employ in all departments about 6,000 men. In the tube mill proper but little change appears to have been made in the last 15 years, except that it has been increased in size, and facilities have been provided for making larger tubes, up to 24 ins. diameter. In the departments which furnish the raw material to the tube mill, however, great improvements have been made. About 15 years ago a new rolling mill was built with Siemens regenerative puddling and heating furnaces, a three-high universal mill for making plates for large tubes, and a continuous mill for making skelp for tube up to 3 ins. diameter. These are all running, but the three-high mill has been altered from a universal to a common mill. The continuous mill, which has 10 stands of rolls, all driven at different speeds by spur gearing from one engine, and which turns out a skelp bar 10 ins. wide by 100 ft. long, remains, as it has always been, one of the marvels of rolling mill practice. Few finer sights are to be seen in any rolling mill than the operation of this mill. After the skelp has passed the last train of the geared rolls, it is carried while still red hot through a separate stand of rolls, which roll the scarf or bevel upon the edges, which is used in lap-welded tubes.

Some years after the erection of the mill just mentioned, another large puddling mill was erected, but the puddling furnaces, instead of being of the Siemens variety, were built of the old-fashioned coal-fired type. Fuel being very cheap at McKeesport, the saving made by the use of the Siemens furnaces probably does not compensate for their high first cost. This mill contains a very heavy mill for rolling wide skelp, consisting of three stands of rolls driven by one engine, and a fourth, or finishing stand, driven by a separate engine.

The practice at the Riverside Iron Works, at Wheeling, W. Va., having shown for some years that tubes could be successfully made from Bessemer steel of a special low carbon grade, as well as from iron, the National Tube Works Co. about three years ago erected a complete Bessemer plant. This now contains two large blast furnaces, a converting plant with three cupolas and two 10-ton converters and a reversing blooming mill for making slabs, which are taken to the skelp mills to be rolled into skelp. The Bessemer plant is of a thoroughly modern type, with most complete arrangements for labor saving. The steel is poured from the ladle into ingot molds standing on cars, which are drawn by a locomotive to the heating furnaces, from which the re-heated ingots are taken to the blooming mill. The old-style casting pit is entirely done away with. The convenience and neatness of the plant are especially noticeable. The entire works are now being run to their full capacity.

The Duquesne Steel Works.

This works, the most recently built of the series owned by the great Carnegie Steel Co., is located at Duquesne, on the opposite side of the river from McKeesport and about two miles below. Its entire product is made into billets and bars, and for this purpose it is, no doubt, the finest mill in the world. Its capacity is extraordinary, for with only two 8½-ton converters it has made as much as 38,000 tons of ingots in a month, and it holds the world's record for a two-converter plant. The ingot molds are carried on cars, as at McKeesport; the ingots are heated in vertical furnaces, and are then rolled directly in a series of mills without reheating into various sizes of billets and bars. The ingots are 17½ × 19½ ins. in cross-section. They are first bloomed in a reversing mill in 15 passes down to about 7 × 8 ins., and the bloom thus made has its ends sheared off and is cut into two pieces; these are instantly carried by conveyors into a roughing mill where they receive five passes, both blooms passing through the rolls at the same time in adjoining grooves. It is a remarkable feature of this mill that the two blooms can be sent into different finishing rolls, as was done during your correspondent's visit, one bloom being rolled into 4×4-in. billets and the other into sheet bar for tin-plate, about 6×1 in. in section. In the complete mill there are in all eight stands of rolls, each driven by a separate engine, in some of which only a single pass is made. To roll an ingot of 17½ × 19½ ins. down to 1½-in. square billets requires 26 passes in the eight stands of rolls. The rolls are not all tandem to each other, only the first three being tandem, and the others placed in two parallel lines, so that the billet or bar in its movement through the mill from one stand to the other passes first forward, then back, then forward again. All the passages are made apparently automatically on power-driven rollers, the only labor required being the movement of the valves of engines and the levers controlling the lifting tables and feeding rollers. After the billets or bars are sheared to length their method of finding their way to the railroad cars in which they are shipped is a fine example of automatic handling of heavy materials. The 4-in. billets drop one by one as they are sheared onto a continuous train of rollers joined at their axles by links, which travel up an inclined track formed of I-beams, then horizontally on an overhead track parallel to the railroad. Switches are provided at several points on the roller track, by which the billets are caused to leave the track and fall into a number of inclined bins or chutes, where they are cooled by a jet of water, and finally, by opening a gate at the bottom of the bin, they fall into the railroad car.

The sheet bars are treated quite differently. They are cut into lengths of about 30 ft., and carried onto a cooling table formed of a number of parallel railroad bars elevated about 3 ft. above the ground level. They are carried along this by a couple of endless chains, which travel at each end of the cooling table, and are finally carried in like manner directly into the railroad cars in which they are shipped. The small number of men required to ship the great product of these works, amounting to as much as 1,400 tons per day, is remarkable. The whole plant is a triumph of engineering skill.

On the ground of the Duquesne Works are now being erected two blast furnaces, which are to be the largest in the world, 100 ft. high and 22 ft. diameter of bosh. They will be finished in a few months, and will undoubtedly beat the world's record for production. Each furnace will be blown with 50,000 cu. ft. of air per minute. The engines are being built by the E. P. Allis Co., of Milwaukee, and the boilers by the Babcock & Wilcox Co., of New York. The ironwork of one stack is now finished, and that of the four ovens for this stack is begun. The ground upon which these furnaces are located was practically a sunken marsh. Piles were driven for the principal foundations, and some of them are about 30 ft. in depth. The foundations are of enormous extent and solidity, and will cost probably as much as the whole of the superstructures. The construction is being hurried to the utmost, electric light being used at night and a great force of men is employed. It would appear as if the constructing engineers had been given carte blanche to make these foundations of the size and strength desired without any regard to cost. It seems a pity that the masonry will be almost entirely hidden under ground when the furnaces are completed. The stock yard is being excavated to a distance sufficient for two additional furnaces, and there is ground enough reserved to extend the plant ultimately to contain six furnaces.

Although great changes have been made in recent years in the size, equipment and method of driving of blast furnaces, the two departments of their work which require manual labor have remained unchanged for centuries—viz., the loading of the stock into barrows in the stockhouse and the removal of the pig iron from the casting houses. Both of these operations are to be conducted by machinery in the new Duquesne furnaces. Hoisting and conveying machines, with steam shovels, are to be used in the stockhouse, so that hand-shoveling and barrow-pushing will be done away with, and the casting house will be served by electric cranes, which will lift a whole bed of iron at once, and convey it to machines which will break it in pieces and load it into cars. If all of this machinery is successful, as no doubt it will be, such a reduction in the labor cost of the making of pig iron will be accomplished as will compel its use in other furnaces, and thus another permanent reduction in the normal cost of pig iron will be effected, which will be of great benefit to those firms which can afford the necessary capital required for the installation of the machinery, and a great detriment to those which cannot afford it. The building of great furnaces is likely to receive an impetus, and the smaller furnaces will disappear, as they have been doing for the last 20 years, under the operation of the law of the survival of the fittest.

The Westinghouse Electric & Manufacturing Co.

The new works of this company cover several acres of ground at East Pittsburg, on the line of the Pennsylvania R. R., 12 miles from Pittsburg. This establishment is practically an immense machine shop, plus a brass foundry and an electrical testing department. It does not contain a cast iron foundry, a lamp factory or a wire-drawing and insulating plant, all of which might be adjuncts of a factory for manufacturing dynamos, motors, etc., yet without these the plant is large enough to employ 3,000 men and women. The motive power of the shops is furnished by a plant of Pierrepont boilers and Westinghouse compound engines. If the shops were located at Niagara Falls, these might be dispensed with, but even there boilers would probably be required in cold weather for the heating

system. Electric heating might be adopted, of course, but even if water power to run the dynamos was obtained for nothing, it is probable that the interest on the cost of water-wheels, dynamos and electric heating apparatus would amount to more than the annual cost of heating by steam. The power is transmitted through the shops by electricity, the dynamos being driven directly by the engine shafts, and motors driving the line shafting. Belting is used to connect the line shafts with the separate tools. Leather belting, therefore, is not entirely displaced by electric motors even in the most modern electric manufacturing shops. Large belts for driving dynamos and heavy main shafts are, however, out of date. Large dynamos are now generally built for direct driving from the engine shaft, and large main shafts are driven by motors.

A notable piece of work now in the shops is a 5,000-HP. generator for the electric plant at Niagara Falls. Two similar ones are now in use at that plant, and the one now under construction is the third. An 800-K-W. generator for an electric lighting station in St. Louis is also being built A large portion of the works is devoted to the manufacture of street railway motors. These are all of the single-reduction type, enclosed in a dustproof cast iron casing. For large street railway cars two 50-HP. motors are now the favorite equipment.

There are signs that the trolley cars are about to be superseded in city street railway service by an underground electric transmission. An experimental track is laid in the yard about the works, which gives great promise of being the street railway system of the future. The current is carried in a wire laid underground and is returned through the rails. A series of cast iron buttons, or mushrooms, about 5 ins. diameter, with a flat top 2 ins. diameter laid above the wire at intervals less than the length of a car, conveys the current through a bar suspended beneath the car its entire length. The car carries a small storage battery, the current from which throws switches which are enclosed in switch boxes located at intervals between the rails, and allows the main current to flow through the buttons into the car, the circuit not being connected to the buttons except when the car is above them, so that when the car is not present it is impossible, except by some means which will move the electric switch, to short-circuit the current from the wire to the rails. The system thus appears to be absolutely safe from any danger to men or animals that may walk upon the track, even though they touch the buttons and the track at the same time.

The Pittsburg Meter Co.

Adjoining the works of the Westinghouse Electric & Manufacturing Co. is a comparatively small shop occupied by a company formerly called the Westinghouse Fuel Gas Co., but now the Pittsburg Meter Co. It manufactures the Westinghouse gas and water meters, and is doing a fair business in both. The gas meter is somewhat similar to the old-fashioned wet meter, in that it contains a gas chamber rotating in a liquid. The chamber is a cylindrical sheet metal vessel, open at bottom, with a rounded top, divided into radial compartments and suspended from the center of the top, in which there is a rotating slide valve. The bottom of the chamber dips into the oil contained in the bottom of the outer casing, and it has a sort of wobbling motion, one side being depressed, and the other elevated, the depressed side constantly changing around the circumference. The top is thus given a rotary motion, which is registered by the ordinary wheel gearing and dials.

The water meter has a curious history. It is an evolution from a rotary steam engine, which was one of the earliest inventions of Mr. George Westinghouse. The steam engine was not a success, but it was found that the same mechanical movement was adapted to a water meter. It consists principally of an outer vertical cylindrical casing and an inner cylindrical piece of hard rubber; the diameter of the latter being considerably less than the interior diameter of the vertical casing, the rubber piece rolls around on the circumference of the casing, continually changing the position of the crescent-shaped space between them. A number of small vertical cylinders of rubber, inserted in grooves in the circumference of the central pieces, move radially across these grooves and press against the outer casing, apparently forming a packing joint. The inner piece contains a number of curved ports, or passages, for the water. On the whole, the meter appears to be somewhat similar to the crown meter. A recent test against eight rival forms of meters is stated to have shown a result superior to any of them.

A New Gas Engine.

An experimental gas engine is now being tried in the works of the Pittsburg Meter Co. It is also one of Mr. Westinghouse's inventions, and looks very much like his well-known steam engine. It is a vertical engine with two cylinders, and gives an impulse to the crank at every revolution. Details are not yet obtainable for publication.

The Westinghouse Machine Co.

Another large works is being built alongside the factory of the Pittsburg Meter Co. It is for the Westinghouse Machine Co., manufacturers of the Westinghouse engine, which will remove from Pittsburg when the building is completed. The foundations are finished, and the framework of the building is being erected. The great air-brake works are at Wilmerding, two miles east of East Pittsburg, and when the Machine Co.'s works are completed, all four of these great Westinghouse concerns will be located within a short distance of each other.

Wheeling, W. Va.

The iron industry of Wheeling suffered severely during the two years of hard times, and many of its nail mills were entirely closed. The price of nails is now about double that of six months ago, and the mills are accordingly busy. One steel works (that of the Riverside Iron Works) formed an exception to the general rule of stagnation, and was run during the whole of the depression. This was because it had a specialty of welded steel tubes of all sizes up to 8 ins. diameter, and especial facilities for making them, so that they could be made and sold cheaper than iron tubes. It consequently obtained more than its share of what trade there was, and the iron tube mills correspondingly suffered. The Riverside Iron Works was the pioneer in making tubes out of Bessemer steel, and after it had made a great success of its enterprise, the National Tube Works followed its example by building its Bessemer steel works.

The works of the Riverside Iron Works are at Benwood, W. Va., five miles south of Wheeling, and comprises one blast furnace, two Bessemer converters, a blooming mill, a mill for rolling the blooms into skelp, and a large tube mill, with furnaces for making both lap-weld and butt-weld tubes. The company also owns a blast furnace at Steubenville. The Bessemer works has a capacity of about 400 tons per day, most of which is made into tubes, although some skelp is sold to other tube makers.

The tube is heated for welding in Siemens furnaces, and welded and straightened by the ordinary processes. The tube is transferred from the welding rolls to the finishing department, where it is cut and threaded by automatic conveyors. The finished tube has a fine, smooth appearance. It is tested for hydraulic pressure and less than 1% fails to pass the hydraulic test.

The writer had a discussion with Mr. E. L. Wiles, the Superintendent of the Bessemer Steel Works, on the question whether steel can be welded. It is, of course, welded to all intents and purposes, when heated in a Siemens furnace, and passed in a second of time through the welding rolls, but the writer expressed his doubts that it could be welded in an ordinary blacksmith's fire. Mr. Wiles, thereupon, showed him a piece of 1½-in. steel rod, 2 ft. long, which had been cut in two and welded by the blacksmith of the works, the welded place hammered down, heated to a red heat, and cooled in water, and the rod then bent into the form of a loop. On inspection, no trace of the weld could be discovered. To show the writer that the piece had actually been welded, the blacksmith reheated it, straightened it under a steam hammer, and then flattened it out under heavy blows at a dull red heat, when the weld was discovered, and the piece was broken apart in the weld; thus proving that the piece had been welded, but that the weld did not form a perfect union of the two original pieces, and was actually a plane of weakness, which could be discovered by sufficiently severe treatment. The blacksmith said, moreover, that he had never seen a piece of either iron or steel which was welded from two pieces in which he could not in like manner discover the weld. As was stated by Mr. Wiles, the answer to the question whether steel can be welded depends on the definition given to the term weld. If it means an absolutely homogeneous union of the jointed surfaces, such as might be made by a glass blower in joining two pieces of glass, then steel cannot be welded; but if it means a sticking together, as two pieces of wood may be stuck together with glue, the joint being strong enough to resist ordinary strains, then it can be welded.

CABLE INCLINE RAILWAYS OF THE WORLD.

The accompanying table, compiled from various sources, presents in condensed form the leading particulars of nearly all the cable incline railways now in operation in this country and abroad. Several of these lines have been described in our columns, and the latest, the Prospect Mountain Ry., at Lake George, was described and illustrated very fully in our issue of Oct. 3. The list gives in all 55 inclines (of which 23 are in the United States), of lengths from 120 ft. to 26,400 ft., and aggregating about 28 miles. Of this total, about 30 inclines, aggregating about 16 miles, have been built specially and almost exclusively for tourist and pleasure travel, which is significant of the extent to which such travel is catered for in these days. The following are some general remarks respecting the different railways included in the table.

United States.

The Catskill, Prospect Mountain, Lookout, and Mount Wilson inclines are purely for pleasure traffic, while the Mount Pisgah and Mount Jefferson inclines, at Mauch Chunk, were built originally for coal traffic, but are now also used for passenger traffic, taking passengers up to the summit of a gravity railway. There are similar planes at Honesdale and Carbondale, Pa. The Pittsburg & Cincinnati lines are for carrying passengers, wagons and carriages, and electric or other street cars between sections of the city which are at considerably different levels, and separated by abrupt slopes or bluffs. There used to be a railway of this kind for carrying horse cars at Hoboken, N. J., but this went into disuse after the opening of the elevated railway of the North Hudson County Ry. Co.

Mount Wilson.—This cable incline is between two other sections of a mountain railway, having maximum grades of 7 and 7½%, both operated by electricity on the trolley wire system.

Cincinnati.—The Mt. Adams incline, owned by the Mt. Adams & Eden Park Inclined Ry., was opened for passengers in 1873, for street cars in 1880, and for electric cars in 1891. The hauling capacity is 20 tons. The maximum speed is 700 ft. per minute. The Bellevue incline (Cincinnati Street Ry. Co.) was opened for passengers in 1876, for street cars in 1890, and for electric cars in 1892. The hauling capacity is 15 tons, and speed 700 ft. per minute. The Fairview incline (Cincinnati Street Ry. Co.) has a hauling capacity of 10 tons, and a maximum speed of 700 ft. per minute. The Price Hill inclines (Price Hill Inclined Plane Ry. Co.) have hauling capacities of 17 and 10 tons for the freight and passenger lines respectively, and both run at 700 ft. per minute. The Mt. Auburn incline (Cincinnati Inclined Plane Ry. Co.) has a hauling capacity of 20 tons, and a maximum speed of 570 ft. per minute. All these lines are operated by steam engines driving winding drums, and the hauling capacities are for unbalanced loads in each case. For the information concerning these Cincinnati inclines we are indebted to Mr. H. J. Stanley, City Engineer.

Canada.

The Hamilton & Barton Ry. is for passengers and wagons. The Montreal incline is purely for

pleasure travel, carrying passengers to the summit of Mount Royal to enjoy the view, while the little Quebec incline avoids a part of the steep climb from the Lower town to the Upper town.

England.

All these inclines are for passenger traffic only, and all are for pleasure traffic except that at Bristol, which affords direct communication between two suburban districts at the top and bottom of vertical cliffs over 200 ft. high.

Switzerland.

Stanserhorn.—This line has three divisions, each operated by a separate cable, and at the upper end of each division is a power house with dynamo and a 60-HP. steam engine, but the regular motive power is furnished by a water-power plant of 175 HP., at Buochs, 2½ miles distant, this plant also furnishing the current for the Burgenstock incline. The lines are single track, with turnouts, and the speeds are about 400 ft. per minute on the first and 280 ft. per minute on the second and third sections. The alinement is nearly straight, but there are curves of 492 to 1,320 ft. radius. The track is of 40-lb. T-rails, bolted to steel track ties, spaced 3 ft. 3⅜ ins., c. to c., some of the ties bearing against two pieces of rail set vertically into concrete blocks, to serve as anchorages. The cables are 0.94, 1.3 and 1.34 ins. diameter.

Lauterbrunnen.—The total length of this road is 18,666 ft., of which 4,566 ft. is a cable incline, and the balance is an electric line with overhead wires, having a maximum grade of 5%.

Italy.

Mount Vesuvius.—This is a double-track line, each track having a single rail on the top of a high timber stringer. Two wheels run on this rail, and there are four small inclined guide wheels running against angle irons spiked against the lower part of each side of the stringer. The crater is 4,197 ft. above sea level, or 312 ft. above the top of the railway. There are two cables, attached to opposite sides of the car. This line is owned and operated by Thomas Cook & Son, the tourist agents.

Brazil.

Santos Incline.—This is a long cable incline by which the San Paulo Ry. ascends from the port of Santos to the high land back from the coast. It is worked in four sections, each having a separate cable driven by an engine of 150 HP. nominal The cables are 1⅜ ins. diameter. There is electric communication between the conductor on the train and the engineman in the power house.

China.

Peak Incline.—This incline extends from the city of Hong Kong to Victoria Gap, on the summit of a hill called the "peak." The line is mainly on embankment, and has 35-lb. T-rails, bolted to steel ties, bedded in concrete 6 ins. thick. The cars weigh 5 to 6 tons loaded, and seat 40 passengers each. The grades vary from 4% to 50%. The lower part of the line has two rails, then comes a double track passing place 130 ft. long, above which the track has three rails. A 66-lb. rail is laid between the track rails, and is gripped by a track brake, which has to be held off by the brakeman. There are two curves, of 500 ft. and 300 ft. radius. There are two horizontal compound engines of 40 HP. at the upper station, driving cast iron drums 8 ft. in diameter.

CABLE INCLINE RAILWAYS OF THE WORLD.

Incline.	Length.	Total rise.	Height above sea level.	Grade, p.c.: Ave.	Max.	Gage, ft. ins.	Size of cable, ins.	Factor of safety of cable	Date.	Motive power.	Rack.	Cost.	Track.
United States.													
Catskill Mountain, N. Y..	7,000••	1,630	...	12	34	3 0	1¼	...	1892	2 steam hoist. engs. of 80 HP.	None	.....	Single-track, with turnout.
Prospect Mountain, N. Y.	6,625•	1,595	2,200	24	37.8	3 0	1¼	...	1895	" " " " " 90 "	"	$120,000	" " "
	6,780••												
Lookout Mountain, Tenn.	4,360••	1,170	2,100	..	35.7	3 0	...	...	....	Steam engs., continuous rope	"	.....	Three-rail.
Mount Wilson, Cal.....	2,000•	1,600	3,500	..	62	. .	...	...	....	Water power, elect.	"	.....	Double-track.
Cameron Hill, Chatta...	1,495••	300	...	20	31	4 0	...	...	1880	.....	.....	.....	Three-rail.
Mount Pisgah, Pa.....	664•	...	...	..	29.8	. .	...	...	1844	Steam hoist. eng.	None	.....	Double-track.
	2,322••												
Mount Jefferson, Pa.....	2,070••	...	...	..	23	. .	...	...	....	" " "	"	.....	" "
Cincinnati, O.:													
Mt. Adams & Eden Pk.	945••	268	774.51	29.59	29.59	7 0	...	...	1873	Steam engines	.....	.....	" "
Bellevue Incline	980••	300	841.92	32.25	32.25	7 6	...	...	1876	" "	.....	.....	" "
Fairview Incline	633.8••	210	805.80	35.12	35.12	7 0	...	...	1894	" "	.....	.....	" "
Price Hill (freight).....	795••	322.69	844.45	44.43	44.43	5 6	...	...	1877	" "	.....	.....	" "
" " (pass.).....	798••	321.35	843.50	44.66	44.66	5 6	...	...	1875	" "	.....	.....	" "
Mt. Auburn	800••	232	838.64	27	30	6 2½	...	...	1872	" "	.....	.....	" "
Pittsburg, Pa.:													
Knoxville Incline	2,640••	375	...	13.8	13.8	9 0	1⅝	...	....	2 steam engines	None	$190,000	.....
St. Clair Incline.....	2,000••	361	...	14.2	....	7 0	1¾	...	....	" " "	.....	60,000	.....
Penn Incline	840••	330	...	39.2	39.2	10 0	2¼	...	....	" " "	.....	320,000	.....
Duquesne Incline	780••	400	...	58.5	58.5	5 0	1¼	...	....	" " "	.....	55,000	.....
Fort Pitt Incline.....	350	...	...	..	....	10 0	...	...	....	Steam	.....	.....	.....
Monongahela (freight)..	640	...	...	..	....	12 0	...	...	....	"	.....	.....	.....
" (pass.)...	640	...	...	..	....	5 0	...	...	....	"	.....	.....	.....
Pittsburg Incline	...	...	...	..	....	. .	...	...	....	"	.....	.....	.....
Mt. Oliver.....	...	...	...	..	....	. .	...	...	....	"	.....	.....	.....
Pitts. & Cas. Shan.(1)..	375	...	...	..	....	10 0	...	...	....	"	.....	.....	.....
" " " " (2)..	2,112	...	...	..	....	10 0	...	...	....	"	.....	.....	.....
Canada.													
Hamilton & Barton.....	700	195	...	..	30.7	8 0	...	...	1892	2 steam engs. of 125 HP.	None	.....	Double-track.
Montreal (Mt. Royal)....	...	...	...	..	....	. .	...	...	....	Steam eng.	"	.....	.....
Quebec (Dufferin Ter.)..	...	...	...	..	....	. .	...	...	....	.....	.....	.....	.....
England.													
Lynton	900	400	...	..	57.8	3 8	⅞	...	1890	Water-balance tank	.....	.....	Dbl.-track close together, spread at turnout.
Bristol	500	230	...	..	45.8	. .	...	...	1893	" " "	.....	.....	Four-track.
Bridgnorth	120	111	...	..	66.6	. .	...	...	....	.....	.....	.....	.....
Folkestone	Very short	...	...	..	47.6	. .	...	...	....	.....	.....	.....	.....
Scarboro	" "	...	...	..	50	. .	...	...	....	.....	.....	.....	.....
Switzerland.													
Stanserhorn	12,877•	4,589	6,063	..	62	3 3⅜	...	...	1893	Water-power electric plant	.....	$300,000	.....
" section 1.....	5,281	900	...	17.6	27	3 3⅜	0.9	...	....	.....	.....	.....	.....
" " 2.....	3,510	1,600	...	55	62	3 3⅜	1.34	...	....	.....	.....	.....	.....
" " 3.....	4,087	2,020	...	57	62	3 3⅜	1.34	...	....	.....	.....	.....	.....
San Salvatore	5,558••	1,973	2,894	38	60	3 3⅜	1.28	9.9	1890	Water-power electric plant	Abt.	117,324	Two-rail, with turnout.
	4,944•												
Biel-Maglingen	5,531•	1,454	2,884	27	32	3 3⅜	1.28	6.3	1887	Water-balance tank	Marsh	90,000	.....
Beatenberg	5,350•	1,825	3,638	34.5	40	3 3⅜	1.75	9	1889	" " "	"	134,170	Sepa. cable to tank & car.
Lausanne-Ouchy	4,800•	995	1,240	7	11.6	4 8½	1.15	9.9	1877	Turbine	None	.....	.....
Lauterbrunnen	4,566••	2,196	4,872	..	60	3 3⅜	1.30	8.5	1891	Water-balance tank	Marsh	166,800	Three-rail.
	3,960•												
Cossouay	4,002•	442	1,859	..	13	3 3⅜	...	...	1894	" " "	Abt.	.....	.....
Burgenstock	3,080••	1,444	2,880	53	57.5	3 3⅜	1.20	10.2	1888	Water-power electric plant	"	60,000	.....
	2,712•												
Ragatz-Wartenstein	2,490•	675	...	26.8	30.4	3 3⅜	1.08	9	1892	Water-balance tank	Marsh	45,000	.....
Territet-Glion	1,815•	981	2,261	54	57	3 3⅜	1.38	9	1883	" " "	"	94,000	.....
Ecluse-Plan	1,260•	358	1,808	27	37	3 3⅜	1.46	13.7	1890	" " "	"	44,000	.....
Giessbach	1,080•	295	2,175	28	32	3 3⅜	0.95	7	1879	" " "	"	30,000	.....
Lausanne-Gare	1,029•	104	...	10	11.6	. .	1.16	10	1879	Turbine	"	.....	.....
Lugano	780•	187	1,106	23	23.8	3 3⅜	1.08	13.5	1886	Water-balance tank	Abt.	37,000	.....
Rives-Thonon	756•	153	1,390	..	22	3 3⅜	...	...	1888	" " "	"	.....	.....
Zurich Berg	534•	125	1,480	22	26	3 3⅜	1.02	8.7	1889	" " "	"	51,870	.....
Gutsch, Lucerne	465•	246	1,700	..	53	3 3⅜	1.2	10	1884	" " "	Marsh	17,200	.....
Marzill, Berne	330•	105	1,772	30.2	30.2	2 7½	0.96	17	1885	" " "	"	14,168	.....
Italy.													
Mount Superga	10,243••	...	...	..	20	. .	...	...	1884	2 steam holst. engs. of 250 HP.	Marsh	.....	.....
Mount Vesuvius	2,688••	1,302	3,885	40	63	. .	1 3-16	...	....	1 steam eng. of 30 HP.	None	$125,000	Single-rail.
Santa Ana, Genoa	1,182••	184	....	14	19	. .	...	...	1892	Water-balance tank	"	.....	Two-rail, with turnout.
Brazil.													
Santos Incline	26,400	2,650	...	..	10	5 3	1⅜	10	....	4 steam engs. of 150 HP.	.....	.....	San Paulo Ry.
China.													
Peak Incline, Hong Kong	4,600•	1,207	...	..	50	5 0	1⅛	...	1888	2 comp. engs. of 40 HP.	None	.....	4-rail to passing place. 3-rail above passing place.

• Length measured on the level. •• Length measured on the incline.

A PROTRACTOR FOR COMPOUND CURVES.

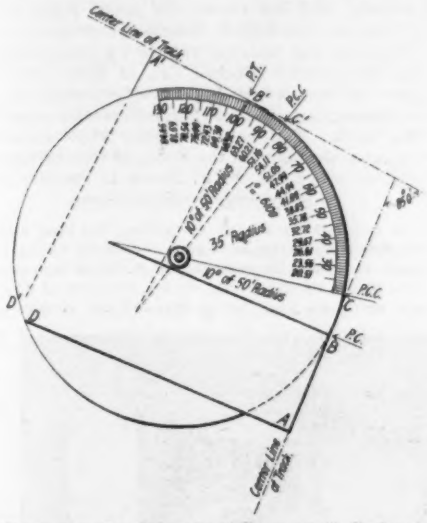
By Harry P. Jones, M. E., Steelton, Pa.

In designing curves and special work for street railways it has been the practice to make constant use of certain radii; in fact, in some cases city authorities have definitely stated what these radii shall be, requiring, for example, a center radius of 35 ft. compounded at each end with 10° of 50 ft. radius.

It is not the intention to discuss here the merits of such a curve or of any special curve, but to explain a method of quickly determining the center line of track and lengths of curves on center line for different central or street angles, a method which, so far as the writer is aware, is new, and which is described here with the belief that, as it greatly facilitates the making of proposal plans and estimates, it may prove of interest.

The proposal plans are usually made to a scale

of 10 ft. to 1 in., and the illustration shows a protractor for 35-ft. center radius. This protractor consists of two sheets of thin celluloid, each having for its boundary a portion of tangent, A-B, sufficient to enable the protractor to be set to a line, an arc of 10° of 50 ft. radius, B-C, and the remainder, C-D, an arc of 35 ft. radius. The two sheets are pivoted at the center of the 35-ft.



Protractor for Compound Curves; H. P. Jones.

radius, and can be adjusted to fit any desired central angle. The upper sheet is divided into degrees, reading from C, the index being the line of compounding, C', of the under sheet.

The protractor is shown set for a central angle of 85°. The length of curve is shown for every 5°, but this scale and also the dividing, may be carried to greater refinement, if desired.

If it is necessary to use a different compounding, say, 50 ft. radius at one end and 75 ft. radius at the other, another sheet is used having the 75-ft. radius substituted for the 50-ft., the pivot being detachable for the purpose of making the change. Thus, any desired compound can be obtained, provided that the center radius remains constant.

In the preliminary designing of car-house work and other specials requiring the location of switches, the protractor has been found of great assistance, enabling the P. C., and therefore the switch, to be located without the calculation of tangents. It can also be determined at once whether a certain curve can be used at a certain point and give car clearance with reference to curb or other obstruction; and if desired, curves may be drawn upon the protractor showing clearances necessary for different lengths and widths of cars.

LONG-DISTANCE POWER TRANSMISSION BY ELECTRICITY AT PORTLAND, ORE.

The falls of the Willamette River, at Oregon City, Ore., 12 miles from the city of Portland, form one of the greatest water powers on the Pacific coast. With an available fall of 40 ft., it is estimated that 50,000 HP. could be developed, and a small amount of power has for some years been utilized by mills and manufacturing establishments near the falls. In addition to this, an electric power station (using the direct current and high-frequency alternating system) was established some years ago to supply current for street and domestic lighting in Portland, and for operating an electric railway between Oregon City and Milwaukee, a distance of seven miles. A new plant is now being installed to operate the electric railways of Portland, and will be one of the largest long-distance transmission plants in the world. This latter plant is being put in by the Portland General Electric Co., which owns the entire water power of the falls, a considerable amount of land in the vicinity, and the canal and locks built to enable vessels to pass to the navigable waterway extending 75 miles above the falls.

The new power plant now partly completed will have a total generating capacity of 12,800 HP., and a quarter of the building (which will, when finished, consist of 20 sections) has been completed, while the foundations for the remainder are now under construction. The structure is of concrete, stone, brick and iron, and will have a total length of 364 ft. parallel with the river. The first of the five sections already built contains the complete equipment of pumps and accumulators; the next three contain each a 600-HP. (or 450-K-W.) three-phase alternating current generator, and the fifth contains two 250-K-W. continuous-current generators used as exciters, each being capable of exciting all of the 20 three-phase generators, and one of these is now furnishing direct current for the electric railways in Oregon City. When the station is completed these exciters will be placed in the middle section, together with the switchboards. The complete power plant will consist of 20 three-phase generators, and the two direct-current generators which act as exciters. The total capacity of 12,800 HP. will be divided into 20 units, each of which can be operated independently of the others.

FIG. 1. VIEW OF INTERIOR OF POWER STATION AT OREGON CITY, ORE., SHOWING HORIZONTAL PLANE DYNAMOS GENERATING ALTERNATING CURRENT FOR TRANSMISSION TO PORTLAND, ORE.

The water-power plant at present erected comprises three sections or units, each consisting of a pair of vertical, cylinder-gate, improved Victor turbines 42 ins. and 60 ins. diameter, running at 200 and 100 revolutions per minute, respectively. The larger wheel is an auxiliary, for use only at periods of excessively high water, which occur at intervals of about five years. Both turbines are set at the same level, and each carries a driving pulley, that of the smaller turbine being fixed to the generator shaft. When the latter is operated alone, the generator is thus driven direct, but when the larger turbine is in operation, the two pulleys are connected by a belt, and the smaller turbine is disconnected, the larger turbine then driving the generator at the same speed of 200 revolutions per minute. Both turbines are regulated by hand wheels, and both are controlled by the same governor, and there is also a belt tightener operated from either floor by a hand wheel. The turbines were built by the Stilwell-Bierce & Smith-Vaile Co., of Dayton, O. The penstocks are 10 ft. diameter, built up of riveted steel plates, and water is admitted to them from the upper canal by means of a headgate operated from a platform. Each turbine has its own flume, the water passing first through that of the larger to that of the smaller turbine, and then being discharged through a tube into the tail race leading to the river, on the other side of the station. The generator shaft is 20 ft. long and 8⅝ ins. diameter, and is coupled to the turbine shaft by a disk coupling, which allows a certain amount of vertical motion or play. The shaft of the 60-in. turbine runs from the coupling to a bearing set in the floor of the station. The weight of the vertical shaft is about 33,500 lbs., and in addition to the ring bearings on the armature shaft, there are two extra bearings, one a ring-thrust bearing and the other an oil bearing. The bearings are enclosed in cases filled with oil delivered by hydraulic pressure, and are surrounded by water jackets. In addition to the turbine plant there is an auxiliary hydraulic plant, including a pump for supplying oil to the bearings and a duplex pump for circulating water in the jackets. These are operated by two 15-in. horizontal turbines enclosed in the same flume. Another pair of 48-in. vertical turbines has also been installed, for the purpose of driving the exciters, these being driven in the same way as the main machines.

The generators are set on the floor of the power station, and are of special design, having armatures 7 ft. diameter and 2 ft. high, which revolve in a horizontal plane and are supported by one bearing at the floor line and another on top of the armature, below the collector rings. These are

shown in Fig. 1. Each generator has 20 laminated poles. The armatures are constructed to deliver current directly to the line conductor at the high working potential of 6,000 volts effective pressure, without the use of intermediate step-up transformers, and extra precautions were therefore necessary to ensure perfect insulation of the armature coils and prevent leakage to the ground. The armatures are wound with flat wire, and each coil is divided into separately-insulated sections. The armatures were subjected to a test pressure of 15,000 volts alternating current, and were both short-circuited and open-circuited under full excitation without any injurious effect. The field coils are wound for an excitation of 500 volts continuous current, and each has been subjected to a test of 5,000 volts alternating current. The exciters have the armatures revolving in a horizontal plane, and supported only by a bearing on the floor line. They are similar to the General Electric Co.'s "M P" type of railway generator, and have each a capacity of 250 K-W. at 125 revolutions per minute.

From the dynamos the leads are run to floor connections and pass underneath the concrete floor to the switchboard. The high-tension switchboards are arranged on the panel system, each panel having a double-pole main switch for the high-potential circuits, and a double-pole double-throw switch for the exciting circuits. There are also a rheostat, current indicators and a potential transformer. The exciter switchboard has three panels, the middle one being a special switching panel, by means of which the current for the Oregon City railway service can be obtained from either exciter. The current passes directly from the generators through the switchboard to the line, a separate circuit being installed for each machine. The line is 14.3 miles long, through an undulating country, and follows the general course of the Willamette River. The loss in transmission at full load is estimated at about 11%. The poles carrying the three-phase wires also carry a number of wires for the 5,000-volt continuous arc current from the old transmission station, as well as the wires for the old system of lighting with high-frequency alternating current of 5,000 volts.

For the electric railway plant of Portland, large amounts of power will be employed, involving the transformation of the polyphase current sent over the line into direct current for the railway circuits. The frequency of the alternating current is 33 cycles per second, this having been selected on account of the large amount of power to be converted. The transformers are at the Portland end of the line, and reduce the current to a potential of 400 volts. For the power service the step-down transformers are connected to rotary converters, which will deliver a continuous current of 500 volts for street railway work and stationary motors. Induction motors directly connected to the secondaries of the step-down transformers will also be used when this can be done to advantage.

The sub-station to which the high-frequency lines are brought in Portland is a two-story building, 40 × 100 ft., and the 45 transformers for the three power units already installed have been put in place. The receiving end of each line is connected to a bank of 15 transformers per generator, five being placed between each pair of wires of the three-phase system. The transformers are mounted on an iron rack, in five rows of three each, as shown in Fig. 2. They are of the standard General Electric sub-station type, having numerous ventilating air passages between bunches of iron laminae and between the coils, so that they may be kept cool when worked at a high output. The transformers regulate at a little over 1% variation of the secondaries from no load to full load. The distribution of lighting current from the secondaries is effected on the Edison four-wire system.

The conversion of alternating current from the line to direct current for the electric railway is effected by the two rotary transformers shown in Fig. 3, which will later be supplemented by three more. Each of these has a capacity of 500 HP. delivered to the bus bars of the continuous current switchboard. The transmission lines for the railway service, like those for lighting, are connected to step-down transformers, which reduce the current from 6,000 volts on the line to 400 volts on the secondaries, from which the current is led into the armature of the rotary converter, which converts it from a 400-volt alternating current into a direct current of 500 volts at no load and 550 volts at full load. These converters are self-regulating, eight-pole machines, with a capacity of 400 K-W. at 500 revolutions per minute. From the converters the wires are led to the power switchboards, on which there are two panels for each converter, one being for the three-phase and the other for the continuous current. The railway current will be carried to the power station of the East Side Ry. by cables under the Willamette River, and this distribution will reach as far as Milwaukee, where connection will be made in parallel with the 600-volt direct-current service from Oregon City. The course will thus be as follows: From Oregon City a 33-cycle three-phase current at 6,000 volts will be transmitted 14.3 miles to Portland, where it will be transformed to a 400-volt alternating current, and thence by a rotary converter to a 600-volt continuous current, which will be transmitted eight miles to Milwaukee, and there connect with the continuous current from Oregon City.

The lighting from the three-phase system is used for large buildings containing several hundred lights each, which buildings are close to the city station, and this distribution can be readily handled at about 400 volts. For the outlying and residence districts the high-frequency apparatus with individual transformers will still be employed. Continuous current will be furnished to the railway and to the stationary motors already installed, but new motor installations will be equipped with three-phase motors operated direct from the three-phase switchboard, in parallel with the rotary transformer.

The plant as thus far erected has worked admirably, and has shown the practicability of applying the three-phase system for general service. The plant was designed and the equipment supplied by the General Electric Co., of New York city, and we are indebted to that company for the accompanying cuts and for information respecting the work. The local company, which owns and operates the plant, is the Portland General Electric Co., of which Mr. P. F. Morey is President.

FIG. 2. VIEW OF TRANSFORMERS IN SUB-STATION AT PORTLAND.

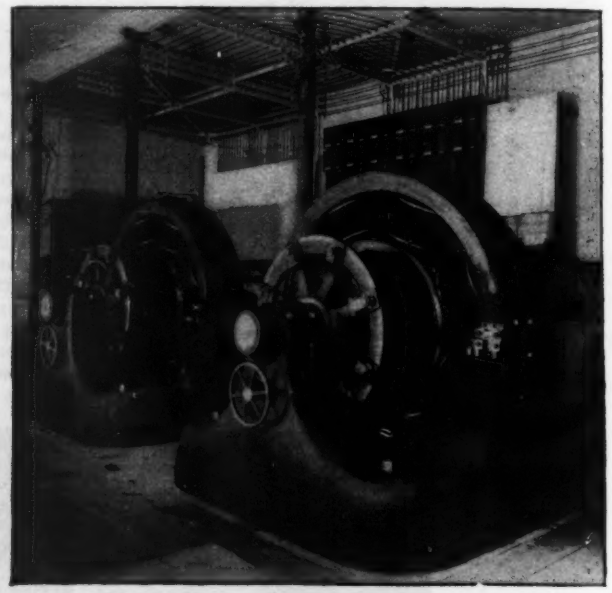


FIG. 3. ROTARY TRANSFORMERS FOR CONVERTING ALTERNATING CURRENT INTO DIRECT CURRENT FOR STREET RAILWAY SERVICE AT PORTLAND.

A rack railway on the Abt system has been built up Snowdon Mountain, in Wales, the upper station being 3,500 ft. above the sea, and 50 ft. below the summit. The line is 4⅝ miles long, with a total rise of 3,140 ft., the maximum grade being 18%, and the average grade 13% The 34 curves aggregate two miles in length, and there are two brick viaducts, 500 ft. and 150 ft. long. There are three turnouts, or passing places. The track is of 41¼-lb. steel T-rails, bolted to rolled steel ties, 3 ft. apart, the joints being spliced by 42-in. bars and six bolts. There are two rack bars, 4-5-in. thick on grades of less than 10%, and 1 in. thick on grades steeper than 10%. They are carried in rolled steel chairs bolted to the ties. The engines have two pinions, driven by cylinders 12 × 24 ins., and each pinion has four brake-shoes. There are four carrying wheels loose on the pinion axles, and a small pair of trailing wheels. Air admission to the cylinders is provided for braking. The engines were built at the Winterthur Locomotive Works, Switzerland. Sir Douglas Fox and Mr. Francis Fox, of London, were the engineers, and Holmes & King, of Liverpool, were the contractors.

The Muskegon Terminal Ry. Co. proposes to establish a railway ferry across Lake Michigan, connecting Milwaukee and Grand Rapids, the latter city lying 40 miles inland from the lake. The route projected is directly east from Milwaukee, 85 miles across the lake to Muskegon, and thence by rail to Grand Rapids. The object of the railway ferry would be to connect the railway systems of Wisconsin with the principal railway center of western Michigan, and thus avoid the 85 to 130 miles detour by way of Chicago. The promoters claim especial freedom from ice blockades by this route.

Storage battery cars are contemplated by the Southern Passenger Ry. Co., of Philadelphia, Pa., for its new line, which is to be built on Carpenter and Reed Sts. The estimates submitted by Mr. W. W. Gibbs, President of the Electric Storage Battery Co., were based on an equipment of 12 cars. The batteries will be carried on the car truck, and will be removed and replaced from a subway in the car shed.

CONTENTS OF SUPPLEMENT.

PERSONALS 113
ENGINEERING SOCIETIES 113
Coming Technical Meetings 113
NEW PUBLICATIONS 114
CONSTRUCTION NEWS:
List of Contracts Pending 114
Railways 114
Street and Electric Railways 115
Electric Light and Power 115
Bridges 115
Buildings 116
Water-Works 116
Irrigation 117
Sewerage 117
Streets and Roads 117
Garbage Disposal 117
Miscellaneous Contracts and Supplies 117
Manufacturing Plants 118
Contract Prices 118
Metal Market Prices 119
INDUSTRIAL NOTES 119

PERSONALS.

Mr. A. C. Wheeler, Superintendent of Terminals of the Texas & Pacific R. R., died on Oct. 4, at El Paso, Tex.

Col. A. L. Rives, General Superintendent of the Panama R. R., has resigned, and will return to the United States.

Mr. Gilbert W. Ledlie, for 30 years auditor of the Flint & Pere Marquette Ry., died suddenly at Saginaw, Mich., on Oct. 4.

Mr. G. M. Stewart has been appointed Acting General Manager of the Interoceanic Railroad of Mexico, to succeed Mr. E. W. Jackson, deceased.

Mr. B. W. Fenton has been appointed Chief Engineer of the Ohio Southern Ry. He formerly held a similar position with the Findlay, Fort Wayne & Western Ry.

Mr. James T. Duff, Chief Engineer of the Consolidated Gas Co., of Pittsburg, died on Oct. 3, aged 74 years. He had been Chief Engineer of the company for 20 years.

Lieut. James B. Cavanaugh has been assigned to take charge of the engineering works under the charge of the late Gen. O. M. Poe, until a permanent successor has been officially appointed.

Mr. Miles McTiernan, of Kansas City, Mo., contractor, and head of the Kansas City Construction Co., was killed by a fall of rock from a blast in a rock quarry near Independence, Mo., Sept. 29.

Mr. Gus Henning, M. Am. Soc. M. E., was elected one of the two Honorary Presidents at the International Technical Conference on the Unification of Methods of Testing, recently held at Zurich, Switzerland.

Mr. C. Harman has received the appointment of Superintendent of the works of the Mount Holly Water Co. This company has recently completed its plant, and is now supplying water to the town of Mount Holly Springs, Pa.

Mr. F. V. Henshaw and Mr. L. W. Downes have entered into partnership as consulting mechanical and electrical engineers, under the firm name of Henshaw & Downes, with offices in the Studley Building, Providence, R. I.

Mr. John Case, contractor, of Chicago, Ill., died in that city Sept. 25, at the age of 72. He was born in England, went to Toronto, Canada, in 1851, and to Chicago in 1870. He had built a number of sewers in the latter place.

Mr. J. T. Mahl has been appointed Engineer of Maintenance of Way of the Atlantic System of the Southern Pacific Ry., the Texas & New Orleans Ry., and the Galveston, Harrisburg & San Antonio Ry., with offices at Houston, Tex.

Lieut. D. D. Gaillard, who until recently has served on the Mexican Boundary Commission, has been assigned to the supervision of the Washington aqueduct. He will work under the direction of Maj. C. E. L. B. Davis, who has general charge of the work.

Mr. A. W. Gates, chief of the city engineering department of Muscatine, Ia., tendered his resignation Oct. 3. Mr. Gates will accept a position with the T. B. Townsend Construction Co., of Zanesville, as superintendent of difficult sewer tunnel work at Peoria, Ill. Mr. Walter M. Hay has been elected his successor.

Mr. W. M. Hughes, M. Am. Soc. C. E., has opened an office as a consulting engineer at 768 The Rookery, Chicago. Mr. Hughes was until recently Principal Assistant Engineer of the Chicago Metropolitan Elevated Ry. He will make a specialty of bridges, viaducts, roofs, buildings and foundations.

Mr. Wm. G. Richards, President of the American Water-Works Association and Superintendent of the water-works of Atlanta, Ga., died on Oct. 1 after a long sickness. Mr. Richards has been connected with the Atlanta water-works for about 20 years, and for a number of years past was Superintendent.

Mr. W. G. Van Vleck, General Superintendent of the Galveston, Harrisburg & San Antonio and Texas & New Orleans roads of the Southern Pacific Ry., has been appointed Manager of the Atlantic system of this road, with headquarters at Houston, Tex. He assumes the position recently held by Mr. J. Kruttschnitt, who has succeeded the late Mr. A. N. Towne as Vice-President.

Mr. E. H. McHenry, of St. Paul, Chief Engineer of the Northern Pacific system, and Mr. Frank G. Bigelow, President of the First National Bank, of Milwaukee, have been appointed receivers of the Northern Pacific property, to succeed Thomas F. Oakes, Henry C. Payne, and Henry C. Rouse, resigned. These appointments were made by Judge Jenkins, of the United States Circuit Court, in Milwaukee.

Dr. Edmund J. James, Professor of Public Finance and Administration in the Wharton School of Finance and Economy, and Professor of Political Science in the graduate department of the University of Pennsylvania, at Philadelphia, Pa., has resigned his position to accept that of Professor of Public Administration in the University of Chicago. He will also have charge of the outside work of the university, including university extension.

Gen. William Mahone, a celebrated Confederate general and late U. S. Senator from Virginia, who died on Oct. 9, at Washington, was engaged in engineering and contracting, both before and after the Civil War. He built the Norfolk & Petersburgh railway, and after the close of the war he became president of the Norfolk & Tennessee R. R. Co., and of the Atlantic, Mississippi & Ohio Ry. General Mahone was born on Dec. 1, 1826, and was educated at the Virginia Military Institute.

Dr. Julius W. Pohle, inventor of the Pohle air-lift system of pumping by compressed air, died in New York Oct. 7. He was born in Berlin in 1829, and became a chemist and analyst. Between 1860 and 1870 he was State Geologist of New York, after which he gave up the medical profession and became connected with the Lebanon Mining Co., operating mines in New York and Colorado. It was while endeavoring to pump out the flooded shaft of a silver mine in Colorado that he devised the method now known by his name. While credit for reducing the invention to practice and bringing it into use belongs to Dr. Pohle, his patent really covered only minor features, the principle of operation having been set forth in several prior patents, as was shown by the description of the pump in our issue of June 8, 1893. The system is controlled by the Ingersoll-Sergeant Drill Co., of New York, with which company Dr. Pohle had been associated for about 18 months.

Mr. Pomeroy P. Dickinson, M. Am. Soc. C. E., died in New York city, on Oct. 4, after a lingering illness. Mr. Dickinson was born near Rochester, N. Y., in 1827. Of his early professional experience we have been able to learn but little, except that he was for a long time engaged upon engineering work in various parts of this country. He was prominent in the first attempt to bridge the Hudson River at Poughkeepsie, and on Jan. 20, 1875, as Chief Engineer of the Poughkeepsie Bridge Co., he entered into a contract with the American Bridge Co., of Chicago, to build this structure. Work was commenced upon two of the river piers; but owing to the death of President. Edgar A. Thomson, of the Pennsylvania R. R. Co., work was abandoned in September, 1878. When the Manhattan Bridge Co. was organized in 1886 and acquiring the rights of the old company made a contract with the Union Bridge Co., for the plans and erection of the present structure, Mr. Dickinson was still connected with the organization. He was made a Member of the American Society of Civil Engineers on Jan. 17, 1872, and was very prominent in the affairs of the Episcopal Church in and about New York as a member of a number of boards and committees.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

INDIANAPOLIS ENGINEERING CLUB.
Oct. 12. Secy., C. C. Brown, City Engineer.
MONTANA SOCIETY OF CIVIL ENGINEERS.
Oct. 12. Secy., Forrest J. Smith, Denver Block, Helena, Mont.
ENGINEERS' CLUB OF KANSAS CITY.
Oct. 14. Secy., F. W. Tuttle, Baird Building.
AM. SOCIETY OF RAILROAD SUPERINTENDENTS.
Oct. 14. Annual meeting at New York. Secy., C. A. Hammond, 143 Liberty St., New York.
COLUMBIAN ENGINEERING SOCIETY.
Oct. 15. Secy., W. F. Hart, University Building, 15th and H Sts. N. W., Washington, D. C.
AMERICAN INT. ASSOC. OF RY. SUPTS. OF BRIDGES AND BUILDINGS.
Oct. 15. At New Orleans, La. Secy., S. F. Patterson, Boston & Maine R. R., Concord, N. H.
AMERICAN STREET RAILWAY ASSOCIATION.
Oct. 15. At Montreal, Que. Secy., John N. Partridge, Brooklyn, N. Y.
AMERICAN INSTITUTE OF ARCHITECTS.
Oct. 15, 16, 17. Annual convention, at St. Louis, Mo. Secy., Alfred Stone, Providence, R. I.
WESTERN RAILWAY CLUB.
Oct. 15. Secy., W. D. Crosman, Rookery Bldg., Chicago.
ROADMASTERS' ASSOCIATION OF AMERICA.
Oct. 15. At St. Louis, Mo. Secy., W. W. Sharpe, Waycross, Ga.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Oct. 16. "Effect of Depth Upon Artificial Waterways," by Thomas C. Clarke. Secy., C. W. Hunt, 127 E. 23d St., New York city.
ENGINEERS' CLUB OF ST. LOUIS.
Oct. 16. "Sewerage of Indianapolis," by C. C. Brown. Secy., W. H. Bryan, Turner Block.
AMERICAN RAILWAY ASSOCIATION.
Oct. 16. At New York. Secy., W. F. Allen, 24 Park Place, New York.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Oct. 16. Secy., F. Van Vleck, Los Angeles, Cal.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Oct. 16. Secy., S. E. Tinkham, City Hall.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Oct. 16. Secy., J. A. Pilcher, Roanoke, Va.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Oct. 16. Secy., R. W. Pope, 26 Cortlandt St., New York.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Oct. 17. Secy., D. Carhart, Carnegie Library, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
Oct. 17. Secy., J. F. Wilson, Odd Fellows' Temple.
NEW YORK RAILROAD CLUB.
Oct. 17. Secy., John A. Hill, 256 Broadway, N. Y.
ENGINEERS' CLUB OF PHILADELPHIA.
Oct. 19. Secy., L. F. Rondinella, 1122 Girard St.
ENGINEERS' CLUB OF MINNEAPOLIS.
Oct. 21. Secy., E. Nexson, Kasota Block.
WISCONSIN POLYTECHNIC SOCIETY.
Oct. 22. Secy., W. K. Means, Loan & Trust Bldg., Milwaukee.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Oct. 24. Secy., C. H. McLeod, Montreal.
ENGINEERING ASSOCIATION OF THE SOUTH.
CONNECTICUT CIVIL ENGINEERS AND SURVEYORS' ASSOCIATION.
Oct. 24. Annual meeting; Middletown, Conn. Pres., Wm. G. Smith.
Oct. 24. Secy., H. D. Ruhm, Nashville, Tenn.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Nov. 1. Secy., O. H. Von Geldern, 819 Market St., San Francisco.
ENGINEERING CLUB OF COLUMBUS, O.
Nov. 2. Secy., David Buell.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Nov. 4. Secy., G. L. Annan, City Engineer's Office.
ENGINEERING SOCIETY OF WESTERN NEW YORK.
Nov. 4. Secy., Geo. R. Sikes, 122 Pearl St., Buffalo, N. Y.
WESTERN SOCIETY OF ENGINEERS.
Nov. 6. Secy., Chas. J. Roney, Monadnock Block, Chicago.
CENTRAL RAILWAY CLUB.
Nov. 8. Secy., H. D. Vought, "Courier" Office, Buffalo, N.Y.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Nov. 12. Secy., F. A. Coburn, Case Library Building.
DENVER SOCIETY OF CIVIL ENGINEERS.
Nov. 12. Secy., H. Breen, 36 Jacobson Block.
NORTHWEST RAILWAY CLUB.
Nov. 12. Secy., G. A. Seley, 80 Metropolitan Block, St. Paul, Minn.
NORTHWESTERN SOCIETY OF ENGINEERS.
Nov. 12. D. W. McMorris, Burke Bldg., Seattle, Wash.
NEW ENGLAND RAILROAD CLUB.
Nov. 13. Secy., F. M. Curtis, P.O.Box 1576, Boston, Mass.
ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
Nov. 14. Secy., Jas. K. Zollinger, Norton Building.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At the meeting on Oct. 2, the president, Mr. Geo. S. Morison, in the chair, Mr. E. C. Moore read a paper on "Moving Two Lines of 36-in. Water Pipe Without Shutting Off the Water," of which an abstract was published in our issue of Sept. 26. Mr. Howard Constable exhibited a number of views of the wrecked portion of the Ireland Building, and called attention to the desirability of establishing new building laws more in accordance with modern methods of construction.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting on Oct. 2 Mr. Richard McCulloch read a paper on "The Continuous Rail in Street Railway Service," describing briefly the work done in St. Louis and elsewhere, and the processes employed. Two systems have been employed in St. Louis, electric welding and cast welding. The latter, requiring a less expensive plant, being simpler and easier to operate, and the work appearing to stand service better, has been given the preference. In spite of the extreme temperatures, a very small percentage of the joints has broken, and the failures were clearly due to defective welds. The cost is not greatly in excess of the old fishplate method. It is thought that the rail being surrounded by earth or paving on all sides except the top it is protected from the extreme variations of temperature, and, being held rigidly in position, these two features tend to counteract the expansion and contraction which would ordinarily be expected.

William H. Bryan, Secy.

AMERICAN SOCIETY OF RAILROAD SUPERINTENDENTS.—The 25th meeting will be held at the Brunswick Hotel, New York, Oct. 14. The reports to be presented include those of the committees on "Roadway," "Machinery," "Transportation," and "Signaling," and that of the special committee on "The Relations of Railways with their Employees." There will also be a paper by Mr. C. A. Morrison, on "Roadway Department Economics." The topics for discussion are as follows:

1.—How far, and with what advantage, can the maintenance of way be placed under the jurisdiction of the Superintendent?

What comparative records of statistics can be profitably adopted to secure economy in the renewal of track and road bed materials, and in the maintenance of the same?

2.—Under what conditions of passenger or freight service has the compound locomotive proved of advantage? Under what circumstances, and with what efficiency?

3.—What are the best methods for securing the prompt handling and despatch of fast freight?

What measures can and ought to be adopted to lessen the cumulative delays of through passenger trains?

4.—Shall we abandon all effort to obtain a "position" signal by night? If not, what progress has been made, or what practical suggestion can be offered in this direction?

Can the green, or caution, signal be safely abandoned in American practice? If not, can there be any im-

provement over white, green and red for night signals? Ought not the installation of interlocking plants at all points where main-track switching has to be done, to precede the introduction of any system of block signaling?

5.—What are the best methods of securing good discipline among employees? Should a system of pensioning be adopted for employees who have rendered faithful and continuous service of 25 years or more?

C. A. Hammond, Secy.

NEW PUBLICATIONS.

OCTOBER MAGAZINES.—"Scribner's" this month has an excellent description of the University of Chicago. It is probably not generally known that the time-honored yearly class system has been abandoned at this university. Instead the year is divided into four quarters, and matriculation and graduation can take place four times each year. Thus any one course continues only twelve weeks, and a student can take only one term in a year and follow some other business the rest of the time, if his necessities require. The number also contains a fine portrait of the late Professor Huxley, with a brief account of his life and work from the pen of Mr. G. W. Smalley. In "The Century" we find an interesting review of Nordau's "Degeneration" from the pen of Lombroso, the greatest living authority on the subject of morbid human development.

"The Popular Science Monthly" has also an article on Huxley, and a paper of much practical interest on "Trout Culture," by Frederick Mather, the well-known pisciculturist. "The Forum" has a paper by Chas. F. Thwing, President of Western Reserve University, urging greater liberality in college endowments, and Jno. G. Speed writes on "Higher Pay and a Better Training for Teachers."

In the "North American Review" Hiram Maxim writes on "Birds in Flight and the Flying Machine," giving a very good review of the modern theories as to the action of birds in soaring flight, and of what has been done in the way of developing mechanical flight. Hon. Edmund G. Ross, Ex-Governor of New Mexico, writes on the "Future of the Arid West," in the course of which he makes some surprising statements. The following is an example:

> A native New Mexican needs no instrument for the securing of levels in locating or laying out an irrigation ditch. Given a known quantity of water supply, he can, with his practised eye, by simply walking over the ground, as exactly determine the course required to insure a uniform flow of water at any desired force, and far more quickly than can the trained engineer with the most perfect instruments. This skill has become a part of his nature, and in a country which must depend upon artificial irrigation for its food product it is a most useful acquirement.

Mr. Ross strongly opposes the control of lands by irrigation companies, and favors the carrying out of irrigation works by the separate states. In the same magazine is a brief paper on "Harnessing the Tides," written by some one who is evidently wholly incompetent to discuss his subject, as the statements which he makes are exceedingly extravagant and ill-founded.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Oct. 11.	Heating and ventilating,	Columbus, Ga.	Oct. 3
Oct. 11.	Sewers (17,000 ft.),	Sharon, Pa.	Oct. 3
	Advertised, Eng. News, Oct. 3.		
Oct. 11.	Water-works,	Marlette, Mich.	Oct. 10
Oct. 11.	Macadamizing,	Glastonbury, Conn.	Oct. 10
Oct. 11.	Macadam road,	Groton, Conn.	Oct. 10
Oct. 11.	Pipe sewers,	Boston, Mass.	Oct. 10
Oct. 12.	River improvements,	Richmond, Va.	Sept. 26
Oct. 12.	Asphalt paving,	Indianapolis, Ind.	Sept. 26
Oct. 12.	Water-works system,	Delhi, N. Y.	Oct. 3
Oct. 12.	Cement sidewalks,	Avondale, O.	Oct. 3
Oct. 12.	Brick paving,	Sandusky, O.	Oct. 3
Oct. 12.	Pipe sewers,	East St. Louis, Ill.	Oct. 3
Oct. 12.	Brick paving,	East St. Louis, Ill.	Oct. 3
Oct. 12.	Laying water pipe,	Bar Harbor, Me.	Oct. 10
Oct. 12.	Water-works,	Grove City, Minn.	Oct. 10
Oct. 12.	Brick sewer,	Cambridge, Mass.	Oct. 10
Oct. 12.	Asphalt paving,	Indianapolis, Ind.	Oct. 10
Oct. 14.	Use of sewage and land,	Salt Lake City.	Sept. 19
Oct. 14.	Pipe sewers (15 m.),	Far Rockaway, N.Y.	Sept. 19
	Advertised, Eng. News, Sept. 19 to Oct. 10.		
Oct. 14.	Intake pipes,	Evansville, Ind.	Sept. 26
	Advertised, Eng. News, Sept. 26 and Oct. 3.		
Oct. 14.	Pump well, etc.,	Evansville, Ind.	Sept. 26
	Advertised, Eng. News, Sept. 26 and Oct. 3.		
Oct. 14.	Removing bridge spans,	Richmond, Tex.	Oct. 3
Oct. 14.	Lumber for New York and B'k'yn Br.,		Oct. 3
Oct. 14.	Grading,	Crawfordsville, Ind.	Oct. 3
Oct. 14.	Reservoir,	Randolph, N. Y.	Oct. 3
Oct. 14.	Paving,	Baltimore, Md.	Oct. 3
Oct. 14.	Building, ventilating, etc.,	Oxford, N. Y.	Oct. 10
Oct. 14.	Pipe sewers,	Boston, Mass.	Oct. 10
Oct. 14.	Macadam road,	Killingly, Conn.	Oct. 10
Oct. 14.	Road,	Milford, Conn.	Oct. 10
Oct. 14.	Repaving,	Allegheny, Pa.	Oct. 10
Oct. 14.	Sewers,	Syracuse, N. Y.	Oct. 10
Oct. 14.	Electric light plant,	Osawatomie, Kan.	Oct. 10
Oct. 15.	Cast iron pipe,	Jacksonville, Fla.	Sept. 19
	Advertised, Eng. News, Sept. 19 to Oct. 3.		
Oct. 15.	Hydrants, etc.,	Jacksonville, Fla.	Sept. 19
	Advertised, Eng. News, Sept. 19 to Oct. 3.		
Oct. 15.	Sewer pipe,	Jacksonville, Fla.	Sept. 19
	Advertised, Eng. News, Sept. 19 to Oct. 3.		
Oct. 15.	Artesian well,	Jacksonville, Fla.	Sept. 26
Oct. 15.	Water-wks system,	Columbus Junc., Ia.	Sept. 26
	Advertised, Eng. News, Sept. 26 to Oct. 10.		
Oct. 15.	Water bonds,	New Palnesville, Minn.	Sept. 26
Oct. 15.	Cement sidewalks,	Indianapolis, Ind.	Sept. 26
Oct. 15.	Naval supplies for Mare Island,	Cal.	Oct. 3
Oct. 15.	Highway swing bridge,	Hamilton, Ont.	Oct. 3
Oct. 15.	Roof covering, etc.,	Washington, D. C.	Oct. 3
Oct. 15.	Crushed limestone,	Toledo, O.	Oct. 3
Oct. 15.	Fireproof room,	Cambridge, Mi.	Oct. 3
Oct. 15.	Macadamizing,	Mount Vernon, N. Y.	Oct. 3
Oct. 15.	Cement sidewalks,	Logansport, Ind.	Oct. 3
Oct. 15.	Belgian block paving, etc.,	Jersey City.	Oct. 10
Oct. 15.	Cement sidewalks,	Indianapolis, Ind.	Oct. 10
Oct. 16.	Plans for city hall,	Somerville, Mass.	Aug. 29
Oct. 16.	Water-works system,	Watertown, Wis.	Oct. 3
	Advertised, Eng. News, Oct. 3.		
Oct. 16.	School building,	Ridgefield, N. J.	Oct. 3
Oct. 16.	Heating court house,	Sherman, Tex.	Oct. 3
Oct. 16.	Macadam road,	Meriden, Conn.	Oct. 10
Oct. 16.	Asphalt paving,	New York, N. Y.	Oct. 10
Oct. 16.	Sewers,	Newport, Ky.	Oct. 10
Oct. 16.	Sewers,	New York, N. Y.	Oct. 10
Oct. 16.	Electric wiring,	Lowell, Mass.	Oct. 10
Oct. 17.	Wharf work,	Tompkinsville, N. Y.	Oct. 3
Oct. 17.	Subway,	Boston, Mass.	Oct. 3
	Advertised, Eng. News, Oct. 3 and 10.		
Oct. 17.	Water-works system,	Philadelphia, N. Y.	Oct. 10
Oct. 17.	Macadam road,	Plainfield, Conn.	Oct. 10
Oct. 17.	Iron or steel bridge	Port Byron, Ill.	Oct. 10
Oct. 18.	Iron bridge,	Oswego, Kan.	Sept. 26
Oct. 18.	Cement, etc.,	Detroit, Mich.	Oct. 3
	Advertised, Eng. News, Oct. 3 and 10.		
Oct. 18.	Water-works system,	Theresa, N. Y.	Oct. 3
	Advertised, Eng. News, Oct. 3 and 10.		
Oct. 18.	Piling, etc.,	Shinnecock & Peconic Canal.	Oct. 10
	Advertised, Eng. News, Oct. 10.		
Oct. 18.	Dredging,	Shinnecock Bay, N. Y.	Oct. 10
	Advertised, Eng. News, Oct. 10.		
Oct. 18.	Macadamizing,	Pomfret, Conn.	Oct. 10
Oct. 18.	Macadam road,	Suffield, Conn.	Oct. 10
Oct. 18.	Public building work,	New York, N. Y.	Oct. 10
Oct. 19.	Public lighting,	Knoxville, Tenn.	Sept. 19
Oct. 19.	Electric light plant,	Norwood, O.	Oct. 3
Oct. 19.	Filling river front at Ft. Wayne,	Mich.	Oct. 10
Oct. 19.	Crushed stone,	Baltimore, Md.	Oct. 10
Oct. 19.	Brick sidewalks,	Indianapolis, Ind.	Oct. 10
Oct. 21.	Pumping engine,	Washington, D. C.	Sept. 12
	Advertised, Eng. News, Sept. 12.		
Oct. 21.	Moving stone in	Kentucky.	Sept. 26
Oct. 21.	Roof for pub. build'g,	Washington, D.C.	Sept. 26
Oct. 21.	Paving,	Toledo, O.	Oct. 3
Oct. 21.	Macadamizing,	Waukegan, Ill.	Oct. 3
Oct. 21.	Pipe sewers,	Bloomfield, N. J.	Oct. 10
	Advertised, Eng. News, Oct. 10 and 17.		
Oct. 21.	Suspension bridge,	Kansas City, Mo.	Oct. 10
Oct. 21.	Canal (30 miles),	Baltimore, Md.	Oct. 10
	Advertised, Eng. News, Oct. 10.		
Oct. 21.	Street lighting,	Seattle, Wash.	Oct. 8
Oct. 21.	Asphalt paving,	Brooklyn, N. Y.	Oct. 10
Oct. 21.	Pipe sewer (1,940 ft.),	Erie, Pa.	Oct. 10
Oct. 22.	Water-wks.,	near Port Townsend, Wash.	Oct. 3
Oct. 22.	Office building,	Danville, Ill.	Oct. 3
Oct. 22.	Pipe sewers (13,300 ft.),	Frankfort, Ind.	Oct. 3
Oct. 22.	Iron bridge,	Annapolis, Md.	Oct. 10
Oct. 22.	Pipe sewers,	Buffalo, N. Y.	Oct. 10
Oct. 22.	Electric lighting,	Beatrice, Neb.	Oct. 10
Oct. 22.	Heating apparatus,	Chicago, Ill.	Oct. 10
Oct. 23.	Pumping plant at	Brooklyn Navy Yard.	Oct. 10
	Advertised, Eng. News, Oct. 10 and 17.		
Oct. 24.	State penitentiary,	Nashville, Tenn.	Oct. 3
Oct. 24.	Sewers,	Washington, D. C.	Oct. 3
	Advertised, Eng. News, Oct. 3.		
Oct. 24.	Plans, court house,	Lesueur Ctr., Minn.	Oct. 10
Oct. 25.	Approaches,	Charleston, S. C.	Oct. 10
	Advertised, Eng. News, Oct. 10 and 17.		
Oct. 26.	Bronze tablet,	Gettysburg Military P'k.	Sept. 12
	Advertised, Eng. News, Oct. 3.		
Oct. 26.	Garbage crematory,	Evansville, Ind.	Oct. 10
Oct. 26.	Pipe sewers (2,750 ft.),	Logan, O.	Oct. 10
	Advertised, Eng. News, Oct. 10 and 17.		
Oct. 26.	Brick sewer (580 ft.),	Logan, O.	Oct. 10
	Advertised, Eng. News, Oct. 10 and 17.		
Oct. 28.	Brick paving,	Lafayette, Ind.	Oct. 10
Oct. 28.	Elec. ry. franchise,	New Philadelphia, O.	Oct. 10
Oct. 28.	Steam plant,	Baltimore, Md.	Oct. 10
Oct. 29.	Brick paving,	Cincinnati, O.	Oct. 10
Oct. 30.	Court house,	South Bend, Ind.	Sept. 26
Oct. 30.	Artesian well,	Denver, Colo.	Oct. 10
Nov. 1.	Plans school building,	Pittsburg, Pa.	Aug. 8
Nov. 1.	Plans for school building,	Pittsburg, Pa.	Sept. 26
Nov. 1.	Dike work,	Philadelphia, Pa.	Oct. 3
	Advertised, Eng. News, Oct. 3 to 24.		
Nov. 1.	County jail,	Detroit, Mich.	Oct. 10
Nov. 4.	Court house,	Morgantown, Ga.	Oct. 3
Nov. 5.	Pile bridges,	Allison, Ia.	Sept. 26
Nov. 5.	Brick court house,	Forsyth, Ga.	Oct. 10
Nov. 8.	Electric light bonds ($15,000),	London, O.	Oct. 10
Nov. 10.	Water-works system,	Honey Brook, Pa.	Oct. 3
Nov. 19.	State capitol,	Olympia, Wash.	Sept. 12
	Advertised, Eng. News, Sept. 12 to Oct. 31.		
Nov. 15.	Swing bridge,	Abbeville, La.	Oct. 10
	Advertised, Eng. News, Oct. 10 to 24.		
Nov. 20.	Drainage canal work,	Chicago, Ill.	Sept. 26
	Advertised, Eng. News, Sept. 26 to Nov. 14.		
Dec. 2.	Sewers (22 miles),	Mobile, Ala.	Sept. 19
	Advertised, Eng. News, Aug. 29 to Oct. 24		

RAILWAYS.

East of Chicago.

AKRON & PITTSBURG.—Incorporated in Ohio, Oct. 4, to build a railway between Akron and a point near the intersection of the Mahoning River and the Pennsylvania state line; capital stock, $10,000; incorporators, A. L. Conger, Jno. H. Sample, J. W. Holloway, K. B. Conger and Jno. C. Frank; principal office, Akron, O.

ARCADIA & BETSEY RIVER.—Incorporated in Michigan, according to reports, with a capital stock of $165,000, by Henry Starke, Maria Starke, Charles J. Starke and Henry Mauntler, all of Arcadia, Mich.

BUFFALO & SUSQUEHANNA.—Tracklaying has been completed on the Wellesville extension of this railway, and we are informed that the ballasting will be finished and the road in operation in about two weeks.

CINCINNATI, JACKSON & MACKINAW.—The contract for building the extension from Addison to Jackson, Mich., 20 miles, has been awarded to George M. Huss, of Chicago.

CLEVELAND TERMINAL & VALLEY.—Incorporated in Ohio, Oct. 3, as a reorganization of the Valley R. R., operating between Cleveland and Valley Junction, Tuscarawas county; capital stock, $7,400,000; incorporators, Moses R. Dickey, Wm. F. Carr, James Bartol, Chas. H. Gale and Fred. H. Goff.

DETROIT & RIVER ST. CLAIR.—Incorporated in Michigan, Oct. 5, with a capital stock of $350,000; incorporators, W. C. Mayburry, C. J. Whitney, Elwood T. Hance, and others. Principal office at Algonac.

MARIETTA TERMINAL.—Incorporated in Ohio Oct. 3, to build a railway from Belpre to a point on the Ohio River at the mouth of the Little Muskingum River; capital stock, $125,000; incorporators, Reuben L. Nye, Theo. D. Dale, H. C. Vincent, Wm. M. Morse, and O. B. Vincent; principal office at Marietta, O.

MONONGAHELA RIVER & SNOWDEN.—Incorporated in Pennsylvania, Oct. 5, to build a railway between Duquesne and a point near Snowden, all in Allegheny county; capital stock, $100,000; Pres., T. O. C. Campbell, Pittsburg.

MUSKEGON TERMINAL.—A press report states that the capital stock of this company will be increased at once to $1,000,000, in order to build a railway 40 miles in length between Muskegon and Grand Rapids, Mich. The scheme contemplates the establishment of a car-ferry line between Muskegon and Milwaukee.

PENNSYLVANIA.—A press report states that this company has decided to extend the Turtle Creek Valley line, which begins at Wilmerding and traverses the bottom of the valley, to the Edgar Thomson plant at Braddock, Pa.

REYNOLDSVILLE, WARREN & BUFFALO.—In our issue of Aug. 29, we noted the incorporation of this company. Active preparations are now being made for construction, and under the direction of S. B. Elliott, Pres., of Reynoldsville, Pa., three corps of engineers are at work on the surveys of the line. The tracks of the Reynoldsville & Fall Creek road will be used between these two places, and the new line will extend from Fall Creek to Warren, Pa.

Southern.

OXFORD & COAST LINE.—Surveyors were last week engaged in surveying the route of this new railway, to be built from Oxford, N. C., to a point about 11 or 12 miles distant on the Durham & Northern. The work of construction will begin at once, and it is the intention to have trains running Jan. 1. This road will give Oxford an important back county connection with the Southern Railway, and the Lynchburg & Durham, at Durham, N. C. Its present only outlet is by a branch road to Henderson, N. C., where connection with the Raleigh & Gaston road of the Seaboard Air Line system is made.

WALTERBORO & WESTERN.—An extension of 12 miles westward is being actively pushed, and it is reported that the road will eventually extend from Walterboro, S. C., to Augusta, Ga.

Northwest.

CENTRALIA & CHESTER.—At the annual meeting of the stockholders, held at Centralia, Ill., Oct. 3, J. D. Gillett, of New York, was elected president; T. B. Needles, of Nashville, vice-president; R. H. Rosebrough, of Sparta, treasurer and general manager, and S. L. Dwight, of Centralia, secretary and general counsel. A number of leading citizens met with the railway committee to discuss the extension of the road to Salem, and accepted a proposition to provide the right of way from Centralia to that place. It is said that the work of extending the road will begin at once.

GULF & MANITOBA.—Incorporated in Iowa, Oct. 1, to construct a railway from a point on the Gulf of Mexico in Texas to a point on the south line of the province of Manitoba; capital stock, $1,000,000; directors, M. H. Kimpton, of Galveston; J. M. Johnson, of McLoud, Okla.; F. B. Johnson, of Topeka; H. M. Lake, of Brookfield, Mo.; C. J. Rundell, of Wayne, Neb.; J. J. Bell, of Des Moines; B. H. Perkins, of Sheldon; E. E. Carpenter, of Canton, S. D.; J. H. Brown, of Jackson, Minn.

MANITOWOC TERMINAL.—The contract for grading and placing piles for bridges on the Manitowoc extension of the Wisconsin Central system has been let to Evans & Richards, of Minneapolis. Press reports state that this connecting link of 27 miles between Hilbert and Manitowoc will form one of the most important extensions yet constructed by the Wisconsin Central, since it means a direct line from Minneapolis to the seaboard via a proposed ferry-car line across Lake Michigan from Manitowoc to Ludington, where connection will be made with the F. & P. M. for the East.

MESABA SOUTHERN.—Incorporated in Minnesota Sept. 30 to build a railway from Cloquet north to the northern boundary line of the state, tapping the Mesabe iron range and reaching the gold fields of the Rainy Lake region; capital stock, $240,000; incorporators, Charles N. Nelson, Stillwater; W. P. Allen, Cloquet; Charles G. Lawrence, R. P. Warren and W. P. Warner, St. Paul; principal office, Cloquet, Minn.

MINNEAPOLIS, NEW ULM & SOUTHWESTERN.—According to a press report from New Ulm, Minn., work will soon begin on a railway to extend from New Ulm southwest to the Missouri River and northwest to Minneapolis, where connections will be made with Duluth. The line is said to be projected by Minneapolis capitalists, and is intended to collect traffic from a section now tributary to Chicago and divert it to the Lake Superior route.

TERRE HAUTE, SAYLOR SPRINGS & MOUNT VERNON.—Henry McPherson, of Boonville, Mo., contractor for the Illinois section of this road, writes us that the work of construction has been suspended until spring on account of difficulty in securing right of way.

Southwest.

KANSAS CITY & LEAVENWORTH.—Incorporated in Kansas, Oct. 4, to operate a railway between Kansas City and Leavenworth, Kan.; capital stock, $500,000; incorporators, W. A. Bunker, of Kansas City; A. Johnson, of Kansas City; J. C. Stone, Jr., of Leavenworth; J. Hannon, of Leavenworth; E. Carroll, of Leavenworth; H. A. Kelfer, of Kansas City, and C. F. Hutchings, of Kansas City.

NEVADA & ELDORADO SPRINGS.—We are informed that the construction of this road, noted in our issue of Oct. 3, will be actively pushed at once.

PINE BLUFF & WESTERN.—This road is projected to run from Pine Bluff to Malvern, Ark., 51 miles. It is

stated that surveys have been made and that it is expected to let contracts at Pine Bluff the latter part of October and to begin grading Nov. 1. There will be no grades to exceed 1%, and no curves to exceed 4°. The road will open up the best timber lands in Arkansas; 60-lb. rails will be used. Pres., John O'Connell, Pine Bluff, Ark.; Ch. Engr., S. Massey, Pine Bluff, Ark.

Rocky Mt. and Pacific.

CALIFORNIA, IDAHO & MONTANA.—Press reports state that articles of incorporation have been filed at Cheyenne, Wyo., for the California, Idaho & Montana R. R. Co., which proposes to construct and operate a railway from Butte City, Mont., to San Francisco; capital stock, $30,000,000. Among the incorporators are Moritz Lippman, of New York; Theodore Voorhees, of Philadelphia; H. M. Dickey, of Chicago.

INTERSTATE CONSTRUCTION & NAVIGATION CO.—A press report from Colorado states that articles of incorporation have been filed for a road to be built from Grand Junction, Colo., to Green River, Utah, connecting with the Union Pacific; capital stock, $100,000; incorporators, Moritz Lippman, W. H. Savidge, H. C. Woodworth, B. F. Woodworth, and H. H. Daniels.

STREET AND ELECTRIC RAILWAYS.

MILBURY, MASS.—The Blackstone Valley St. Ry. Co. has been incorporated to build an electric road six miles long between Millbury, Grafton, Sutton and Southbridge; capital stock, $100,000; directors, F. A. Lapham, of Worcester, Mass.; Charles Buck, J. H. Howe, of Grafton, Mass.; L. E. Chase, of Sutton, Mass., and S. M. Snow, of Providence, R. I.

CROTON-ON-HUDSON, N. Y.—The Croton Valley Electric Ry. Co. has been incorporated to construct a narrow-gage railway about four miles long from the New York Central R. R. station in Croton-on-Hudson to the new Cornell dam; capital stock, $10,000; directors, Chas. F. Grattan, Edward White, Robert B. Wright and others, of Croton-on-Hudson.

IRONDEQUOIT, N. Y.—The Irondequoit & Lake Shore Electric R. R. Co. has been incorporated to construct a railway nine miles long from Forest Lawn, in Webster, Monroe county, to a point near the intersection of the shore of Lake Ontario with the easterly bank of the Genesee River, in Irondequoit; capital stock, $100,000; directors, A. J. Johnson and Joseph C. Tone, of Irondequoit; Joseph A. Johnson, Frank W. Elwood and EdwardS. Ellwanger, of Rochester; E. O. McNair and David W. McNair, of Warsaw.

NIAGARA FALLS, N. Y.—The Niagara Falls St. Ry. Co. has been incorporated to construct a railway from Niagara St. and Riverway, this city, to Highland and Maryland Aves., in the Mile Reservation; capital stock, $50,000; directors, Arthur G. Denniston, Charles S. Hinchman, George L. Estabrook, Jr., Joseph S. Clark, Robert J. Byron, of Philadelphia, Pa.; James S. Simmons, E. H. Stewart, Walter P. Horne, and Spencer J. Lawrence, of Niagara Falls.

SHERMAN, N. Y.—It is proposed to construct an electric railway from Chautauqua to Sherman, Findley Lake, N. Y., and to North East, Pa. A. B. Minton and W. L. Minton, of Westfield, N. Y., and F. A. Ellis, J. L. Thayer and T. S. Harman, of Sherman, are interested.

TOWANDA, PA.—Aaron F. Chapman, of Buffalo, N. Y., is reported to have been awarded the contract for constructing an electric railway between Towanda and Canton.

WILKES BARRE, PA.—Carle & Flanagan, of Wilkes Barre, have been awarded the contract for building the Luzerne, Dallas & Harvey's Lake Electric Ry., 14 miles long, according to reports.

BALTIMORE, MD.—Bids are asked until Oct. 28 for constructing the steam plant for the Baltimore, Middle River & Sparrow's Point R. R. Co. The work will include two 225-HP. engines, etc. Pres., James Young; Ch. Engr., Chas. B. McClean, 304 East Baltimore St. (Towson); Gen. Man., Frank P. Lewis, Fairy, Md.

FREDERICK, MD.—The aldermen have granted the Frederick & Middletown Ry. Co. a franchise for its electric road, surveys for which are now being made. The power house for this road will be erected at Braddock Spring.

WETHEREDVILLE, MD.—The Wetheredville, Franklintown & Edmondson Ave. Electric Ry. Co. has been incorporated with a capital stock of $25,000; incorporators, William Ferguson, Joseph Henry Judik, Pres. People's Bank, Baltimore; Charles W. Dorsey, Dr. Joseph C. Monmonier and Levi Z. Condon.

BRIDGEWATER, VA.—It is reported that the proposed electric railway from Basic City to Bridgewater, surveys for which are being made, as noted in our issue of last week, is to be about 28 miles long. Edward P. Wilson and G. W. Berlin, of Philadelphia, are interested.

JACKSONVILLE, FLA.—The Jacksonville St. Ry. Co. has decided to extend its electric road to Panama Park. Pres., D. F. Jack; Engr., M. H. Motte.

CINCINNATI, O.—It is reported that the Columbus Scenic Ry. Co. has been organized to build scenic railways, etc.; capital stock, $15,000; John J. Shipherd, M. H. Solloway, W. E. Hutton, J. M. Hutton, W. D. Hutton.

LIMA, O.—It is stated that a company will soon be incorporated to build an electric road, with branches 52 miles long, to Piqua, Wapakoneta and St. Marys. Wm. H. Hartman, 534 South Main St., Lima, and B. C. Faunot are interested.

NEW PHILADELPHIA, O.—Bids are asked by the county commissioners until Oct. 28 for the purchase of a franchise for an electric or compressed air single-track railway between New Philadelphia, Midvale and Uhrichsville. E. C. Browne, County Audr.

SANDUSKY, O.—It is reported that Reid Carpenter, of Mansfield, and others have purchased the Sandusky, Milan & Norwalk Electric R. R., which they propose to extend to Mansfield, by way of Plymouth. M. D. Harter is interested.

CHICAGO, ILL.—The Chicago City St. Ry. Co. has been granted a charter; capital stock, $5,000,000; Philip Snyder, Alexander Gillman, F. E. Russell and C. A. Hull are interested.

MILWAUKEE, WIS.—It is reported that the Bluff City Inter-Urban Electric Co. has begun the construction of an electric railway between this city and Chicago, at an estimated cost of $500,000. C. E. Loss, of Chicago, is interested.

ST. JOSEPH, MO.—The St. Joseph Traction & Lighting Co. has sold its property, and the company will be reorganized with an increased capital stock. The electric railway will be improved and extended, for which $500,000 in bonds will be issued, according to reports. Gen. Supt., W. T. Van Brunt.

TACOMA, WASH.—The City Park Ry. Co., Gen. Man., S. W. Hampton, and the Tacoma Ry. & Motor Co., Supt., J. H. Davis, have petitioned for permission to extend their electric roads on a number of streets, at an estimated cost of about $100,000.

PASADENA, CAL.—Prof. T. S. C. Lowe has applied for a franchise for an electric road to connect with the Mount Lowe electric railway.

SAN JOSE, CAL.—The board of trade has acted favorably on a petition of J. F. Pieftch and L. M. Hale to construct an electric railway to Saratoga.

ELECTRIC LIGHT AND POWER.

BRIDGEWATER, MASS.—It is stated that an electric light plant is about to be erected at the Bridgewater state farm. Consult. Engr., Geo. F. Dyer.

LOWELL, MASS.—Bids are asked until Oct. 16 for electric light wiring the post-office building in this city. Gardner W. Pearson, Custodian, Post Office Bldg.

PAWTUCKET, R. I.—W. A. Chapman & Co., of Providence, have been awarded the contract for constructing the power station and gate house at Pawtucket Falls for D. L. & L. B. Goff. The buildings will be 138×52 ft., and work will be begun at once.

FLUSHING, N. Y.—The village trustees have been petitioned by a New York electric lighting company for a franchise.

MOUNT VERNON, N. Y.—It is reported that the question of granting an electric franchise will soon be voted upon. If the plant is constructed as proposed, it will also supply power for a system of waterworks.

BLOOMFIELD, N. J.—John P. Conklin has petitioned the township committee for an electric light franchise.

MAUCH CHUNK, PA.—The council of East Mauch Chunk is considering the question of constructing an electric light plant, at an estimated cost of $12,500.

PHILADELPHIA, PA.—The "Record" states that the recently inaugurated movement to absorb several of the electric light companies operating in the central portion of the city has its principal backing in the Pennsylvania Heat, Light & Power Co. W. W. Gibbs, Pres. Electric Storage Battery Co., is authority for the statement that it is the intention of the Pennsylvania company to negotiate for the purchase of several of the electric light systems, and, failing in this, it would enter the field independently, for which there has already been secured subscriptions for $5,000,000 of its capital stock, and it is intended to commence operations very soon. The Pennsylvania, Heat, Light & Power Co. was granted a franchise by councils early last summer, to operate between the two rivers and Girard Ave. and South St. A short time ago the company secured the services of Capt. Edward B. Ives, formerly chief engineer of the Electric Traction Co., and the recent organization of an active engineering corps has given color to the statements that the company intends to avail itself of its valuable privileges at an early date.

BATESBURG, S. C.—An electric plant of 100 incandescent lights is about to be constructed for the Batesburg cotton mills.

EUFAULA, ALA.—It is proposed to construct an electric light plant of 75 arc and a number of incandescent lights. P. B. McKenzie, Mayor.

CHATTANOOGA, TENN.—It is reported that the Chattanooga Light & Power Co. is making arrangements to build a new electric light plant, at an estimated cost of $50,000.

BARDSTOWN, KY.—An electric light plant is to be constructed in this city at once, according to reports.

LONDON, O.—Bids are asked until Nov. 8 for the purchase of $15,000 of electric light bonds. John Redden, Cy. Clk.

CLARENCE, MICH.—It is reported that the construction of an electric light plant is being considered.

NASHVILLE, MICH.—C. F. Hough, Cy. Clk., writes us that the city will not put in an electric light plant this season.

OSAWATOMIE, KAN.—Bids are asked until Oct. 14 for constructing an electric light plant at the insane asylum. Arch., J. C. Rollins, Topeka; Morton Albough, Pres. Bd. Trustees, Osawatomie.

BEATRICE, NEB.—Bids are asked until Oct. 22 for furnishing 34 arc lights. J. P. Saunders, Chn. Com.

NEVADA, MO.—Plans have been prepared for the proposed plant for the Nevada Electric Ry., Light & Power Co. Pres., Geo. W. Dudley, St. Louis; Secy., C. F. Strohen.

KERRVILLE, TEX.—Charles Schreiner, of Kerrville, has petitioned the council for an electric light franchise. It is hoped to begin work on the plant at once, and to have it completed in about 90 days.

TACOMA, WASH.—Press reports state that the White River Water Power Co. is making arrangements to construct flumes from the White River to convey water for power purposes to Lake Tapps, where a reservoir is to be constructed. Chas. E. Warner and E. H. McHenry, Ch. Engr. Northern Pacific Ry. Co., are interested. Consult. Engr., Rudolph Hering, of New York.

SEATTLE, WASH.—Bids are asked by the secretary of the board of public works until Oct. 21 for lighting the streets for one year.

BINGHAM CANYON, UTAH.—It is stated that O. B. Hardy and W. J. Moorhead have petitioned the county court at Salt Lake City for an electric light franchise in the West Mountain mining region.

NEW COMPANIES.—Clearfield Light, Heat & Power Co., Clearfield, Pa; $5,000.

Sharon Electric Co., Sharon, Conn.; $10,000; J. N. Bartram, E. C. Gillette, C. C. Gordon, Sharon, Conn.

Block Light, Heat & Power Co., Denver, Colo.; $25,000; William J. Barker, John H. Poole, A. E. Grier, Denver.

Victor Electric Co., Chicago, Ill.; $2,400; to manufacture electrical machinery; C. F. Samms, J. B. Wantz, E. P. Vickers.

Chamberlain Electric Lighting Co., Chamberlain, S. Dak.; $10,500; C. D. Tidrick, W. L. Montgomery, Chamberlain; E. W. Pitts, Alton, Ia.

Equitable Electric Light Co., Baltimore, Md.; $50,000; Henry A. Parr, John Cowan, George R. Webb, J. William Middendorf, Richard R. Culbreth.

Citizens' Light, Heat & Power Co., Columbus, O.; $200,000; Charles A. Knight, R. T. McDonald, Fort Wayne, Ind.; Thomas Cooper, D. C. Beggs, R. R. Rickly, Columbus.

Dwyer Motor Wagon Co., Portland, Me.; $100,000; to manufacture gasoline, petroleum, electric and other motors; Pres., George H. Hewitt; Treas., Theodore Leete, Springfield, Mass.

American Electric Forge Co., Newark, N. J.; $100,000; to forge, smelt and weld metals by electricity; George D. Burton, Boston; Alfred C. Garsia, New York; Bernard J. Fredericks, of Arlington, N. J.

Bordentown Electric Light Co., Bordentown, N. J.; $50,000, with $2,000 paid in; James S. Gilbert, William C. Steele, George B. Gilbert, of Bordentown; Thomas Bennett, Amos L. Lyttle, Philadelphia, Pa.

Wilson-Bates Electric Co., New York, N. Y.; $1,500; to manufacture telephones and all kinds of electrical or magnetic machinery; William C. Wilson, George B. Bates, Henry G. Issertel, New York, N. Y.

Shuttleworth Electric Co., Camden, N. J.; $100,000, with $10,000 paid in; to manufacture electrical apparatus; Alpheus C. Shuttleworth, Hugh M. Quinn, Philip R. Wells, Frankford, Pa.; J. L. Burt, Holly Beach, N. J.

Holmes & Bassett Co., Waterbury, Conn.; $20,000; to manufacture and deal in curtain fixtures, electrical appliances, etc.; Walter W. Holmes, Charles L. Holmes, Waterbury, Conn.; Fred H. Bassett, Saranac Lake, N. Y.

Vandergrift Gas, Fuel, Telephone, Electric & Power Co., Apollo, Pa.; $8,000; to operate in the town of Vandergrift, near Apollo; E. H. Vandergrift, J. L. Buchanan, D. L. Rhodes, George Mercer, V. Preston, Pittsburg.

Central New York Light & Power Co., Oneida and Canajoharie, N. Y.; $100,000; H. Walter Webb, Wm. H. Geisheunen, New York; Wm. J. Arkell, Canajoharie; Judson M. Warner, of Oneida; Alden M. Young, Waterbury, Conn.

Metropolitan Electrical Development Co., Jersey City, N. J.; $1,000,000, with $2,500 paid in; to manufacture storage batteries, engines, motors, etc.; John R. Dos Passos, Thos. D. Jordon, Chas. J. Canda, New York; Conrad N. Jordan, Brooklyn, N. Y.

BRIDGES.

FALL RIVER, MASS.—Plans have been prepared for a trestle bridge over the Old Colony R. R. at Davol St. for the Globe St. Ry. Co.'s electric line. The structure will be 1,000 ft. long, 15 to 22 ft. wide and 24 ft. above the tracks. Gen. Man., R. S. Goff.

PITTSFIELD, MASS.—It is stated that the Pittsfield Electric St. Ry. Co. will build an iron bridge 75 ft. long. Gen. Man., P. C. Dolan.

NEW HAVEN, CONN.—The city engineer has been directed to advertise for bids for constructing a drawbridge over the Quinnipiac River at Grand Ave.

BRIDGETON, N. J.—We are informed that the following bids were received Oct. 3 for constructing an iron drawbridge over the Cohansey River at Broad St.; Joseph T. White, A. Harrs and William Leach, Committee:

	Old pier.	New pier.
Berlin Iron Br'ge Co., E. Berlin, Conn.	$13,000	$14,562
Wrought Iron Bridge Co., Canton, O.	12,000	15,000
Edgemoor Bridge Co., Wilmington, Del.	12,700	15,436
Nelson & Buchanan, Chambersburg, Pa.	14,000	17,900
Cox & Son, Bridgeton, N. J.	12,469	14,746
Youngstown Bridge Co., Youngst'n, O.	12,746	16,950
Groton Bridge Co., Groton, N. Y.	13,800	15,800
Massillon Bridge Co., Massillon, O.	13,700	16,800
Toledo Bridge Co., Toledo, O.	14,600	16,900
Dean & Westbrook, New York	14,000	16,900

NEWARK, N. J.—The freeholders of Essex and Hudson counties are making arrangements to have the question of building a bridge at Madison St., between the two counties, voted upon at the November election. John Boyd, Clk. Hudson County.

ANNAPOLIS, MD.—Bids are asked by the commissioners of Anne Arundel county until Oct. 22 for building a 65-ft. iron bridge over Marley Creek. A. K. Starlings, Clk.

ABBEVILLE, LA.—Bids are asked until Nov. 15 for constructing a steel swing bridge, with a 170-ft. steel drawspan, over Vermilion Bayou at Abbeville, as stated in our advertising columns. W. W. Edwards, Chn. Com.

CLEVELAND, O.—Plans have been prepared for a new bridge 290 ft. long at Willow St. over the old riverbed, estimated to cost about $100,000.

INDIANAPOLIS, IND.—The county commissioners have decided to pay $7,500 towards the construction of a new bridge at Prospect St., estimated to cost $15,000, and it is probable that the Cleveland, Cincinnati, Chicago & St. Louis Ry. Co. will pay the remainder.

CHICAGO, ILL.—The construction of a viaduct; estimated to cost about $140,000, to connect the North and South Side park systems is being considered.

LA SALLE, IND.—Press reports state that the Illinois Central R. R. Co. will build a new $1,000,000 steel bridge across the Illinois River in this city. The old bridge, built in 1868, was condemned several years ago.

PORT BYRON, ILL.—Bids are asked until Oct. 17 for constructing a steel or iron highway bridge over the Chicago, Burlington & Quincy R. R. three miles from Joslin, Frank Zimmerman, Wm. H. Ashdown, James H. McConnell, Highway Comrs., Port Byron.

GRAND FORKS, MINN.—It is reported that the Great Northern Ry. Co. is about to build a new steel bridge over the Red River at this place, at an estimated cost of between $35,000 and $40,000.

KANSAS CITY, MO.—Bids are asked until Oct. 21 for building a wire suspension bridge and four wooden bridges. Address T. J. O'Flaherty, County Surv.

SPRINGFIELD, MO.—The county court has directed the county surveyor to prepare plans and specifications for an iron bridge over the Jordan River at West Olive St.

KANSAS CITY, MO.—H. H. Filley, Cy. Engr., has completed specifications for the proposed viaduct at Allen Ave. and 23d St., estimated to cost $32,000.

BUILDINGS.

BOSTON, MASS.—Andrews, Jacques & Rantoul, 8 Beacon St., have prepared plans for a four-story stone warehouse, 225 × 90 ft., to cost $400,000, for J. Murry Howe & Bradley, 28 State St.

BUFFALO, N. Y.—Charles A. Johnson, 78 Broadway, New York, has bought 350 ft. frontage on Main St., near Jefferson St., as a site for a theater and convention hall. Work will be begun soon on the building, which is estimated to cost $300,000. Charles H. Gallagher, 120 Broadway, New York, is also interested. Archs., M. E. Beebe & Son, of Buffalo.

NEW YORK, N. Y.—Bids are asked until Oct. 18 for the steel and iron work in the U. S. Appraiser's warehouse, from the third to the tenth floor inclusive. Wm. M. Aiken, Supervising Arch., Washington, D. C.—John Fallon has been awarded the contract for building the new branch of school No. 9, at Vanderbilt Ave. and Sterling Place, at $112,000.—Plans have been filed by Blake & Nassy, 30 West 132d St., for four five-story brick flats on 88th St., to cost $100,000. Archs., Webster & Thompson; by Frederick Haas, 307 West 38th St., for a seven-story brick flat at West End Ave. and 91st St., to cost $105,000. Arch., W. O. Tall; by McNeil Taylor, 51 East 117th St., for seven five-story brick flats on 116th St., to cost $260,000. Arch., Edward Wens.—The plans prepared by John De Pais, 337 Fourth Ave., for the new four-story police station, prison and stable, to cost $100,000, for the 9th Precinct, at 133 to 137 Charles St., were adopted by the Sinking Fund Commission Sept. 27.

OXFORD, N. Y.—Bids are asked until Oct. 14 for constructing a building for the New York state veterans' home in this city, and for heating, ventilating and plumbing the building. Arch., I. G. Perry, Albany. Address F. G. Clarke, Oxford, or the architect.

RAHWAY, N. J.—Plans have been adopted by the commissioners for the proposed state reformatory buildings, estimated to cost $600,000. The structure will contain 1,000 cells. A meeting of the commissioners will be held Oct. 11 to make arrangements to begin the construction, for which $100,000 was appropriated by the legislature last winter. Arch., John P. Thomas, New York.

ALLEGHENY, PA.—The following bids were received Sept. 27 by the supervising architect at Washington, D. C., for erecting the superstructure, roof covering, etc., for the U. S. public building in this city, as advertised in Engineering News:

Item 1, limestone; 2, additional for marble; 3, aluminum dome.

McDonald Bros., Allegheny City, Pa., item 1, $73,766; 2, $52,212; 3, $940 additional; time, 12 months.

J. J. Churchyard, Buffalo, N. Y., 1, $79,917; 2, $40,000 Rutland, $26,000 dark Rutland, $35,000 blue Rutland; 3, $1,034 additional; time, 1 year.

C. Thomas & Son, Washington, D. C., 1, $102,020; 2, $10,500 dark Rutland; time, 18 months.

Frank Baldwin, Washington, 1, $69,652; 2, $25,665 Rutland; time, 12 months.

Geo. W. Corbett, Washington, 1, $74,200; 2, $31,914 Proctor; 3, $73,800; time, 1 year.

Manning & Parsons, Washington, 1, $78,000; 2, $38,000; 3, $78,800; time, 10 months.

Richardson & Burgess, Washington, 1, $75,997; 2, $39,000 Proctor; $25,500 dark Rutland; 3, $75,600; time, 280 working days.

L. L. Leach & Sons, Chicago, Ill., 1, $63,289; 2, $33,500 Vermont; 3, $61,289; time, 10 months.

Geo. A. Cochrane, Washington, 1, $69,950; 3, deduct $4,335; time, 1 year.

Kunkel & Jordan, Allegheny, Pa., 1, $75,000; 2, $46,675; 3, $76,700; time, 11 months.

Charles A. Moses, Chicago, 1, $57,750; 2, $36,250; 3, $55,500; time, 1 year.

Henry Sheuk, Pittsburg, 1, $72,989; time, 10 months.

Amberg Granite Co., Chicago, 1, $148,700 using granite; 3, deduct $15,000; time, 1 year.

PHILADELPHIA, PA.—Plans are about completed for the surgical amphitheatre, estimated to cost $100,000, to be erected by the Medico-Chirurgical College and Hospital. Address Dr. L. Webster Fox.

PITTSBURG, PA.—J. H. Silsbee, of Chicago, Ill., has prepared plans for a new building for the zoological gardens in Schenley Park. The building will be 650 ft. long, about 60 ft. wide, and is estimated to cost about $125,000. Edward M. Bigelow, Dir. Dept. Pub. Wks.

BALTIMORE, MD.—The following bids have been received by Capt. Eric Bergland for the construction of the Cedar Point lighthouse:

James H. Coster & Son, Baltimore	$7,740
Edgar Zillian, Wilmington, Del.	7,740
Aquila Mitchell Carroll, Baltimore	7,948
I. H. Hathaway & Co., Philadelphia	8,715
Francis H. Smith, New York	16,420

Ironwork.

Russel Wheel & Foundry Co., Detroit	$845
Ryan & McDonald Mfg. Co., Baltimore	1,179
E. J. Codd Co., Baltimore	1,177
Robert Poole & Sons Co., Baltimore	1,325
Campbell & Zell Co., Baltimore	1,650
Allentown Rolling Mills, Allentown, Pa.	900
Chamblin, Delaney & Scott, Richmond, Va.	944
Tacony Iron & Metal Co., Tacony, Pa.	1,013
John P. McGuire, Cleveland, O.	875
Petersburg Iron Works, Petersburg, Va.	1,661

ASHVILLE, N. C.—We are informed that Charles Hutchinson and Martin A. Ryerson, of Chicago, Ill., are about to build two large residences. Plans for the ground are being prepared by Wm. Law Olmstead, of Boston, the landscape architect.

RALEIGH, N. C.—Wm. H. Tucker, 250 Fayetteville St., is about to award contracts for constructing a block of four-story business houses.

CHARLESTON, S. C.—Bids are asked until Oct. 25 for constructing the approaches to the post office, court house, etc., in this city, as stated in our advertising columns. Wm. Martin Aiken, Supervising Arch., Washington, D. C.

FORSYTH, GA.—Bids are asked until Nov. 5 for erecting a two-story brick court house for Monroe county. Archs., Bruce & Morgan, of Atlanta; address T. E. Fletcher, Clk.

CINCINNATI, O.—It is stated that Samuel Hannaford & Sons, Hulbert Block, are about to ask for bids for reconstructing the Music Hall, at an estimated cost of $150,000.

WARREN, O.—E. M. Campfield, of Findlay, O., was the lowest bidder, at $140,273, for constructing a new county court house. The county commissioners received 20 bids, ranging from $140,273 to $221,277.

DETROIT, MICH.—Bids are asked by the board of county auditors and supervisors' committee until Nov. 1 for constructing a county jail of 200 cells, not to cost more than $150,000, on a lot 213 × 105½ ft., at Clinton, Blanbien and Raynor Sts. Henry M. Reynolds, Secy.; Chn., W. H. Hoyt.

CHICAGO, ILL.—Bids are asked until Oct. 22 for putting a steam-heating apparatus in the temporary postoffice building, this city. W. M. Aiken, Supervising Arch., Washington, D. C.—J. E. O. Pridmore is preparing plans for a six-story apartment house, to cost $130,000, and Dinwiddie & Newberry are preparing plans for an apartment house on the North Side to cost about $300,000.

ALGONA, IA.—A vote will be taken Nov. 5 on the question of constructing a new jail. C. C. Chubb, Chn. Bd. Supervisors.

LESUEUR CENTER, MINN.—Plans are asked until Oct. 24 for a new county court house, estimated to cost about $65,000. Joseph Rachac, County Audr.

HELENA, MONT.—The capitol building commission has decided to award the following prizes for the best plans for the new state capitol building, estimated to cost $1,000,000: The architect whose plans are accepted will be given supervision of the work and 5%; a cash prize of $1,500 to the architect submitting the second best plans; $1,000 for the third best, and $500 for fourth best plans and designs. The commission is composed as follows. Gov. John E. Richards, Chn.; W. M. Bickford, of Missoula; Chas. F. Lloyd, of Butte; C. K. Cole, of Helena; Wm. K. Flowesee, of Chateau, Teton county.

ST. LOUIS, MO.—P. F. Meagher & Son, 701 Fagin Bldg., have prepared plans for a 10-story, 116 × 50 ft., office building for Conde L. Benoist, 4006 Maryland Ave., to cost $125,000.

WATER-WORKS.

BAR HARBOR, ME.—Bids are asked by the Bar Harbor Water Co. until Oct. 2 for laying about 13,000 ft. of 8-in. pipe, according to reports. F. C. Coffin, 53 State St., Boston, is now preparing plans for an earth dam, with masonry core, to be built on Eagle Lake, the source of supply.

PARIS, ME.—A project is said to be under consideration to furnish Paris Hill with a gravity supply.

YORK, ME.—We are informed that the York Shore Water Co. will soon be ready to advertise for bids for the construction of its plant. It is probable that only a part will be built this fall. Engs., Dennet & Jose, Saco, Me.

HATFIELD, MASS.—W. D. Billings, Town Clk., writes us that nothing has been done about the proposed water-works further than to accept the provisions of the act passed by the last legislature, and it is not certain that anything further will be done this fall.

LAWRENCE, MASS.—A. D. Marble, Cy. Engr., has reported plans for a high-water service, for which the estimates are as follows: Engine, etc., $3,100; piping, $28,975; metal stand-pipe, $6,000; masonry tower, $11,300; additional gates, $225; add 15%, $7,400; total, $57,000.

WINCHENDON, MASS.—B. D. Whitney writes us that water commissioners were to be elected Oct. 9, and that no engineer has yet been engaged or definite plans made for the proposed works; estimated cost, $100,000.

EAST PROVIDENCE, R. I.—The report of the fire district officials recommends the construction of a new stand-pipe, at an estimated cost of $28,000, and that authority be secured to spend $100,000 upon the works, in addition to the $150,000 named in the charter.

AKRON, N. Y.—James D. Childs, Village Clk., writes us that an election will be held Oct. 15 to vote on the question of works, as noted last week.

CLIFTON SPRINGS, N. Y.—L. M. Bement, Clk., writes us that nothing has been done in regard to works except to circulate a petition.

LITTLE FALLS, N. Y.—S. E. Babcock, Cy. Engr., is preparing plans for increasing the water supply, which, we are informed, has been unusually low the past season. H. W. Warren, Cy. Clk.

PHILADELPHIA, N. Y.—Bids are asked until Oct. 17 for constructing works. Engrs., Hinds & Bond, Watertown; I. C. Mosher, Secy. Comrs.

PORTVILLE, N. Y.—This village has voted in favor of incorporation, and it is stated that steps will soon be taken to put in water-works.

SCHENECTADY, N. Y.—The General Electric Co. is reported as taking steps to construct a water system for its own use.

WARREN, N. Y.—This place is reported as discussing the question of municipal water-works.

WEST CARTHAGE, N. Y.—A contract for constructing works has been awarded to A. F. Nims, of Philadelphia, N. Y., at $11,600. The work will include the laying of 480 ft. of 10-in. pipe across the river. We are informed that the other bids were as follows:

Spicer, Young & Thompson, Carthage	$12,488.48
Munson & Lewis, Herkimer	12,715.95
Lanphere & Morris, Watertown	13,856.55
Ferris & Knapp, Watertown	14,198.85
Taft & Dole	15,257.77

WHITESBORO, N. Y.—P. A. Hale, Town Clk., writes us that works will not be constructed this year. Surveys have been made, but no other steps taken.

YONKERS, N. Y.—The commissioners have contracted with the New Rochelle Water-Works Co. for a daily supply of 1,500,000 gallons. It is stated that wells are being sunk in the hopes of securing an additional supply.

BELMAR, N. J.—S. L. Gillin, Clk., writes us that Lehlback Bros., of Newark, have been engaged to make plans and preliminary surveys for the proposed water-works, sewers and roads.

ALLEGHENY, PA.—The finance committee has sold $650,000 of water bonds to a New York firm, for $689,292.50. These are said to be five-year bonds, the last of the $1,250,000 authorized in 1892.

BELLEVUE, PA.—The council voted in favor of issuing $50,000 in bonds for water-works, and the question will be submitted to a vote of the taxpayors next month.

DUQUESNE, PA.—E. L. Cuthbert, Clk., writes us that the bonds have not yet been printed, although sold, and that nothing has yet been done in regard to securing plans or awarding contracts.

ELIZABETH, PA.—The town council is reported to have accepted a proposition of the Elizabeth Water Co. for a daily supply of 1,000,000 gallons, and it is stated that works will be constructed at once.

HAZLETON, PA.—It is stated in this city that the Lehigh Valley R. R. Co. is about to sink 16 artesian wells to secure a water supply for its engines and collieries.

WILKES BARRE, PA.—The Campbell's Ledge Water Co., incorporated Oct. 2, 1894, is having plans prepared for works to supply towns in the Wyoming and Lackawanna valleys with water from the Susquehanna River, at a cost of nearly $1,000,000. This company will furnish water to the Consumers' Water Co., of this city, which is composed of practically the same directors, and to the other companies that will construct works in the different cities and villages in the Wyoming Valley. It is stated that bids for the intake dam were received Oct. 1, and that the pipe is now being ordered. Consult. Engr., Lewis E. Davis, of New York; Geo. H. Butler, Secy., Wilkes Barre.—The Crystal Spring Water Co. is reported as about to dredge its reservoir, at a cost of $300,000 to $400,000, and to make other improvements to its works.

HYATTSVILLE, MD.—The Village Improvement Society is considering plans prepared by a Baltimore engineer for works, estimated to cost $10,000, or $15,000 with a steel stand-pipe. W. H. Richardson, Secy.

GRAFTON, W. VA.—It is reported that West Grafton will soon have water-works, the supply being from this place.

MONROE, N. C.—The town authorities are said to have decided in favor of works, and are now investigating the system best adapted to this place. From the information sent to this office, we judge that this investigation is being carried on without the services of a competent engineer.

KEY WEST, FLA.—Jim Brough, of Tampa, Fla., is reported to have been engaged to superintend the construction of a reservoir at this place.

BIRMINGHAM, ALA.—Julian Kendrick, Cy. Engr., writes us that a franchise has been granted to Caldwell Bradshaw and others for another water-works system, as noted in our issue of Sept. 19.

NEW IBERIA, LA.—Owing to a $20,000 fire recently, the necessity of works is being agitated.

PADUCAH, KY.—W. H. Patterson, Clk., writes us that an ordinance submitting the question of issuing bonds for works to a vote of the citizens Nov. 5 was to be placed upon its final passage Oct. 7.

WEST COVINGTON, KY.—An agreement is reported to have been made whereby the citizens will soon have works.

ELYRIA, O.—Dr. P. D. Bryce, of Toronto, Ont., Secy. Provincial Bd. of Health, is reported to have stated, after investigation, that the only source which this city can depend upon for a water supply is Lake Erie. This would necessitate a pipe line eight miles in length, and it is reported that the city will probably adopt this measure.

HOMEWORTH, O.—It is reported that this village may soon have works.

MIDDLETOWN, O.—An election will be held next month to vote on an issue of $25,000 in bonds for water-works extensions.

YELLOW SPRINGS, O.—The proposition to build works is said to have been defeated at the recent election by one vote.

YOUNGSTOWN, O.—The contract for two new pumping engines has been awarded to William Tod & Co., at $39,500. The detailed bids were printed last week under Contract Prices.

MARLETTE, MICH.—Bids are asked until Oct. 11 for two duplex pumps, a pump well 30 ft. in diameter and 28 ft. deep, a pumping station, and for trenching and laying about three miles of pipe. H. C. Morris, Village Clk., writes us that the pipe has been purchased from the Lake Shore Foundry, of Cleveland, and the hydrants from James Flower & Bros., of Detroit.

AURORA, ILL.—The following bids were received for another artesian well, 10 ins. in diameter at the top and 6 ins. at the bottom, and 2,250 ft. deep:

W. H. Gray & Bros., Chicago	$6,975
American Wells Works, Aurora	5,625
J. P. Millar & Co., Chicago, Ill.	5,350
L. Swanson, Minneapolis, Minn.	5,250

CHICAGO, ILL.—Local papers state that Joseph Duffy has withdrawn his bid for section 1 of the northwest land tunnel, and that the contract has been awarded to the next lowest bidder, Fitz Simons & Connell, of Chicago, at $147,350. The bids were published in our issue of Sept. 5.

TOLUCA, ILL.—The citizens have voted 71 to 16 in favor of issuing bonds for works.

COLUMBUS, WIS.—A petition is being circulated asking that an election be held Nov. 15 to vote on an issue of $25,000 in bonds for the construction of works. It is said that the proposition will probably carry.

FOND DU LAC, WIS.—The council is taking steps to require the water company to furnish a better water supply. It is stated that the company will sink another well. P. P. Linneen, Secy. W. W. Co.

HIGHLAND, WIS.—The citizens have voted 120 to 16 in favor of works, and it is stated that the village board will award contracts as soon as possible.

MAUSTON, WIS.—The contract for constructing works, except the reservoir, has been awarded to Fairbanks, Morse & Co., of Chicago, at $9,400. The report states that there will be about 5,000 ft. of pipe and 11 hydrants, and that the reservoir contract was awarded at $1,300.

DULUTH, MINN.—Resolutions have been introduced in the council providing for an issue of $1,000,000 in bonds, and directing the city engineer to prepare detail plans and specifications for works to supply the whole city, in accordance with the result of the recent election.

GROVE CITY, MINN.—Bids are asked until Oct. 12 for

constructing works, including power house, pumping engine, tower 80 ft. high, with a 20 × 24-ft. tank, about 2,000 ft. of 8 to 4-in. mains, 4 hydrants and 3 valves. J. N. Gayner, Village Recdr., writes us that Fairbanks, Morse & Co., of St. Paul, prepared the plans; population, 328.

LE SUEUR, MINN.—The citizens have voted to issue $20,000 in bonds for water-works and electric lights.

BEATRICE, NEB.—Willis Ball, Cy. Engr., writes us that no steps have yet been taken in regard to obtaining a pure water supply.

LISBON, N. DAK.—G. H. Davies, Cy. Audr., writes us that an election will be held Oct. 22 to vote on an issue of $10,000 in bonds for works estimated to cost that amount; no plans have yet been prepared; the water supply will probably be from a well near the Cheyenne River; population, 1,000.

GREAT FALLS, MINN.—M. S. Parker has been engaged to investigate the water problem in this city.

NEWTON, KAN.—The works at this place were transferred to the city Sept. 26 for $75,000. The city has $10,000 on hand to experiment with the natural water supplies about the city, and a contract has been let for boring one well.

JULESBURG, COLO.—The citizens have voted to issue $10,000 in bonds, and it is stated that the construction of a reservoir will be commenced at once.

LAKEVIEW, CAL.—The Lakeview Heights Water Co. was incorporated Sept. 28, with a capital stock of $600,000, with $519,800 paid in, by E. J. Wilber and A. Nixon, of Chicago; Mrs. Abby Thompson and A. P. Campbell, of Lakeview, Riverside county, Cal., and others.

NEVADA CITY, CAL.—Fred M. Miller, of Grass Valley, is the designing engineer of the new works, for which it is proposed to issue $60,000 in bonds, as noted last week. The city lies in a V-shaped valley, and it is proposed to construct one reservoir on each side of the city at same elevation. Consult. Engrs., Nusbaumer & Bordman, of Oakland, Cal.

SAN LUIS OBISPO, CAL.—At an election Sept. 26 the citizens voted, 325 to 147, to issue $90,000 in bonds for the construction of water-works.

KENDRICK, IDAHO.—The citizens have voted to issue $11,000 in bonds for works.

VERNON, B. C.—The city engineer of Vancouver is reported as preparing plans for works at this place.

KINGSTON, ONT.—It is reported that a new pumping engine will soon be purchased, and that a local company has offered to build it for $14,000.

IRRIGATION.

DENVER, COLO.—Bids are asked until Oct. 30 for sinking an artesian well near Holyoke, Colo.; bond, $10,000. H. A. Sumner, State Engr.; F. Cogswell, Deputy State Engr., Denver.

SAN ANTONIO, TEX.—The San Antonio Irrigation Co. is about to purchase excavation machinery, water gates, pipes, etc. Engr., Z. A. Socker.

WACO, TEX.—J. W. Riggins is interested in an irrigation project in this state, according to reports.

PHOENIX, ARIZ.—Donald Grant, of Faribault, Minn.; A. H. Linton, of Minneapolis, Minn., and others, are now selling $3,000,000 in bonds for constructing a canal to irrigate 300,000 acres of land near this city.

NEW COMPANIES.—Fort Hill Land & Water Co., of Claremont, Pomona, Cal.; $100,000, with $17,750 paid in; Christopher Hanson, of Los Angeles; Frank S. Mead, Edwin E. Cole, Henry Hanson, Pomona.

San Lorenzo Water Co., Hollister, Cal.; $300,000, with $240,000 paid in; Wm. K. Brown, John L. Gardner, N. C. Briggs, P. L. Brown, G. S. Nash, Hollister.

SEWERAGE.

RUTLAND, VT.—Bianco & Grinaldi, of Cambridgeport, Mass., were awarded the contract at $2,496 for constructing 3,250 ft. of 6 and 8-in. pipe sewers with 4-in. subdrain, as advertised in Engineering News. John Sheehan & Co., of Lynn, Mass., bid $3,928, and Frank L. Allen, of Worcester, Mass., $4,493. Sidney Smith, Cy. Engr.

BOSTON, MASS.—Bids are asked until Oct. 14 for constructing about 1,500 ft. of 12 to 8-in. pipe sewers. Henry B. Wood, Acting Supt. of Sts.

BOSTON, MASS.—Bids are asked until Oct. 11 for constructing about 3,000 ft. of 18 to 10-in. pipe sewers in Blue Hill Ave. H. B. Wood, Acting Supt. Sts.

CAMBRIDGE, MASS.—Bids are asked until Oct. 12 for constructing about 3,100 ft. of 36 × 32-in. brick storm sewers in two streets; bond, $5,000. L. M. Hastings, Cy. Engr.

TAUNTON, MASS.—The commissioners have engaged Rudolph Hering, of New York, to report on a plan for an outlet sewer.

NEW HAVEN, CONN.—The committee has recommended the construction of sewers in six streets.

BINGHAMTON, N. Y.—The state board of health has recommended the construction of a better system of sewerage. Consult. Engr., John Bogart; S. E. Monroe, Cy. Engr.

KINGSTON, N. Y.—The following bids were received Sept. 27 for constructing the 2d and 9th ward trunk sewer, 14,450 ft. of brick, as advertised in Engineering News; W. Klingberg, Cy. Engr.; J. E. Diamond, Chn. Com.; Aug. Schepmoes, Cy. Clk.:

	Rock excav., per cu. yd.	Lumber, per M. ft.	Total.
Charles W. Collins	$1.00	$15	$57,207
F. H. Clement & Co.	2.75	35	48,000
Campbell & Dempsey	2.25	15	45,333
Peter Morgan	4.00	20	43,880
Francis Curnan	2.75	25	51,954
McGarry & McGowan	4.50	20	53,340
M. W. Lasher & Co.	....	..	63,000

Thos. J. Cusack, informal.

BUFFALO, N. Y.—Bids are asked until Oct. 22 for constructing 15 to 10-in. pipe sewers in two streets. R. G. Parsons, Secy. Dept. Pub. Wks.——The council has directed the board of public works to prepare plans and specifications, and advertise for bids for constructing a 12 and 15-in. pipe sewer in Reservation Ave.——The board of public works has received the following bids for constructing a sewer in South Park Ave.: Dan Delaney, $3,800; F. J. Koglin, $3,650; F. J. Martin, $3,877; John Harrer, $3,300; William Franklin, $3,300; Henry Kebbin, $3,953; Mumm & Sell, $3,640; Henry Harter, $3,598; Elmer Mighton, $3,800; Christ Smith, $3,197; Jacob Rittman, $3,400; August Gisel, $5,587.

NEW YORK, N. Y.—Bids are asked by the department of public works until Oct. 16 for constructing sewers in five streets.

NYACK, N. Y.—The citizens voted Oct. 8, 96 for and 79 against, the construction of a system estimated to cost $50,000. Engr., Jas. S. Haring; E. H. Cole, Clk.

ROME, N. Y.—At an election held Sept. 30 it was voted to issue $240,000 in bonds for constructing a system, plans for which have been prepared by the Stanwix Engineering Co.

SYRACUSE, N. Y.—Bids are asked until Oct. 14 for constructing a 54 to 20-in. brick sewer in Midland Ave. and 18 to 12-in. pipe sewers in three streets; four checks of $500 each. H. F. Stephens, Cy. Clk.

BELMAR, N. J.—S. L. Gillen, Clk., writes us that Lehlbach Bros., of Newark, have been engaged to prepare plans and make surveys for sewers, roads and waterworks.

BLOOMFIELD, N. J.—Bids are asked until Oct. 21 for constructing 1,578 ft. of 10 and 8-in. pipe sewers in Belleville Ave., as stated in our advertising columns. Engr., A. H. Olmsted; Wm. L. Johnson, Township Clk.

ERIE, PA.—Bids are asked until Oct. 21 for rebuilding the State St. sewer from Fifth to Tenth St., a distance of 1,940 ft., with either a 24-in. double-strength pipe sewer in the center of the street or two 15-in. pipe sewers on both sides. George Platt, Cy. Engr.

NEWNAN, GA.—It is reported that the construction of a system is being considered.

MAYFIELD, KY.—J. N. Crutchfield, Cy. Engr., writes us that a new council will be elected in November, when the question of constructing a system will be considered.

NEWPORT, KY.—Bids are asked until Oct. 16 for constructing sewers in three streets. W. L. Glazier, Cy. Engr.

LOGAN, O.—Bids are asked by the committee until Oct. 26 for constructing 580 ft. of 30-in. brick and 2,750 ft. of 20 and 15-in. pipe sewers, as stated in our advertising columns. Engr., Frank Snyder, Columbus; H. E. Sparnon, Clk.

DETROIT, MICH.—The board of public works has been directed to advertise for bids for constructing sewers in four streets. James Dean, Pres. Bd. Pub. Wks.

PONTIAC, MICH.—Peterson & Co., of Bay City, Mich., were awarded the contract for constructing a system of 24 to 12-in. pipe sewers, at $16,374, as advertised in Engineering News. The highest bid was $41,890. E. R. Webster, Secy. Comn.

CRAWFORDSVILLE, IND.—J. D. Tracy, Cy. Clk., writes us that nothing will be done till next spring towards the construction of a system.

AURORA, ILL.—The city engineer is making surveys for a system on the west side.

CHAMPAIGN, ILL.—Press reports state that the council has directed the city clerk to advertise for bids for constructing the proposed system, at an estimated cost of $76,000, which amount the city proposes to collect by special taxation. Consult. Engr., Prof. A. N. Talbot.

CHICAGO, ILL.—Nelson Hallgren, Town Clk., Cicero, writes us concerning the proposed 5½-mile sewer in Cicero to Mud Lake, that the court has not yet fully confirmed the trustees' decision to begin the construction of the sewer, which is estimated to cost about $200,000. Engr., Harry A. Potwin.

CHICAGO, ILL.—G. L. Clausen, Supt. of Sewers, writes us that plans are completed for 16 miles of 12 to 3-ft. sewers for the proposed 83d St. system, estimated to cost $1,295,000, with an average cut of 20 ft. The money is to be raised by special assessment, and the contract will be awarded in the spring unless delayed in the court. W. D. Kent, Comr. Pub. Wks.

MONTICELLO, ILL.—It is reported that a system is to be constructed.

KANSAS CITY, KAN.—The following bids were recently received for constructing a sewer in district No. 16: R. E. Elea & Co., Kansas City, Kan., $24,525; George J. Baer, Kansas City, Mo., $27,194; T. J. Enright, Argentine, Kan., $28,580; P. McDonald, Kansas City, Mo., $29,062. There is a probability that new bids will be asked. C. A. Ellis, Cy. Engr.

INDEPENDENCE, MO.—G. W. Coakley, Cy. Clk., writes us that an election will be held Oct. 15 to vote on the question of issuing $50,000 in bonds for building about 5½ miles of main sewer from the city to the Missouri River. Engr., Wynkoop Kiersted, 58 Water-Works Bldg., Kansas City, Mo.

LITTLE ROCK, ARK.—Theodore Hartman, Cy. Engr. and Supt. Bd. Pub. Wks., writes us that preliminary work and estimates only have been made for the proposed 91,000 ft. of 18 to 8-in. pipe sewers (average cut 8 ft.), estimated to cost $53,000.

PORTLAND, ORE.—The council has voted to construct a 24-in. brick sewer in Hawthorne Ave., and 22 to 10-in. pipe sewers in 10 other streets. A. N. Gambell, Audr.

SEATTLE, WASH.—The board of public works received the following bids Sept. 27 for constructing a sewer in three streets: C. J. Erickson, $2,966—awarded contract; M. O'Day, $3,738; J. W. Fitts, $3,372; George B. Worley, $3,000; George B. Kittinger, $2,904; Flynn & Rockmark, $2,974; J. A. Bailey, $3,731.

LOS ANGELES, CAL.—The committee has recommended the construction of sewers in three streets.

SAN FRANCISCO, CAL.—The street committee is considering the question of directing the city engineer to make surveys for a system in the district south of Golden Gate Park lying between First and 20th Aves.

SAN LUIS OBISPO, CAL.—The city has voted to issue $34,500 in bonds for sewers, according to reports.

STREETS AND ROADS.

NORFOLK, MASS.—The Massachusetts Highway Commission received the following bids at Boston Oct. 1 for constructing a road in this place; Chas. Mills, Ch. Engr., Boston: Charles McDermott, Brockton, $3,602; Hendricks, Taylor & Warner, Northampton, $3,036 (awarded contract); Andrew Carberry, East Walpole, $3,068.50; Raphael Fiorani, Franklin, Mass., $3,412.50; James McGovern, Dorchester, $3,298.

PROVIDENCE, R. I.—Arrangements are being made to construct sample half-mile roads in Warick, Johnson, Bristol, Warren, Barrington and a number of other towns in Rhode Island, estimated to cost a total of $30,000. Work will be begun at once. C. F. Chace, State Comr. Roads.

GLASTONBURY, CONN.—Bids are asked until Oct. 11 for macadamizing a road. E. E. Olcott, First Selectman, Glastonbury.

GROTON, CONN.—Bids are asked until Oct. 11 for macadamizing. Engrs., Daboll & Crandall, 94 State St., New London; Wm. H. Allen, First Selectman, Groton.

KILLINGLY, CONN.—Bids are asked until Oct. 14 for constructing a macadam road. Oliver W. Bowen, Selectman.

MERIDEN, CONN.—Bids are asked by the selectmen until Oct. 16 for constructing a macadam road.

MILFORD, CONN.—Bids are asked until Oct. 14 for macadamizing a road. Elbert L. Ford, Selectman.

PLAINFIELD, CONN.—Bids are asked until Oct. 17 for building a macadam road. Engr., C. E. Chandler, Norwich; W. H. Kenyon, Selectman, Moosup, Conn.

POMFRET, CONN.—Bids are asked until Oct. 18 for macadamizing a road. Engr., C. E. Chandler, Norwich; Herbert Sharpe, Selectman, Pomfret.

ROCKY HILL, CONN.—C. A. Cadwell, of New Britain, has been awarded the contract for building a macadam road.

SUFFIELD, CONN.—Bids are asked until Oct. 18 for macadamizing about 2,000 lin. ft. of road. Edmund Halladay, Selectman.

ALBANY, N. Y.—Contracts for about 50,000 sq. yds. of brick paving are to be awarded before January. Horace Andrews, Cy. Engr.; Thos. J. Lanahan, Clk. Bd. Contract.

BROOKLYN, N. Y.—Bids are asked until Oct. 21 for repaving Dean St. with asphalt. A. T. White, Comr. Cy. Wks.

BROOKLYN, N. Y.—The board of aldermen proposes to pave portions of 8 streets with asphalt at an estimated cost of $161,000, and two other streets with granite blocks at a cost of $42,000. Alfred T. White, Comr. Cy. Wks.

NEW YORK, N. Y.—Bids are asked by the department of public works until Oct. 16 for asphalt paving in two streets.——The commissioner of public works has been authorized to pave 59,505 sq. yds. with asphalt at an estimated cost of $238,200.——The Aqueduct Commissioners have received the following bids for constructing a highway crossing the east branch of reservoir D, in Kent, Putnam county: Thos. F. McLaughlin, $16,535; Richard Dooling, $13,074; John Flanagan, $13,057; Crowden & Lauder, $12,919; Patrick F. Curran, $11,637; Peter J. Doherty, $16,627.

JERSEY CITY, N. J.—Bids are asked until Oct. 15 for 7,270 sq. yds. of Belgium block paving, about 12,000 sq. ft. of flagging, bridge stone, etc. John C. Kaiser, Chn. Com.; Geo. T. Bouton, Clk. Bd. St. Comrs.

ALLEGHENY, PA.—Bids are asked until Oct. 14 for repaving in three streets. Robert McAfee, Dir. Dept. Pub. Wks.

ERIE, PA.—We are informed that State St. is to be repaved with either brick or asphalt. George Platt, Cy. Engr.

PITTSTON, PA.—The council has voted to advertise for bids for paving three streets with brick or asphalt.

BALTIMORE, MD.—Bids are asked until Oct. 19 for furnishing 3,000 perch of crushed stone along the line of the Baltimore & Jerusalem turnpike. Simon J. Martenet, Pres. Baltimore & Jerusalem Turnpike Co., P. O. box 424, Baltimore.

RALEIGH, N. C.—H. F. Smith, Cy. Clk., writes us that no definite action has as yet been taken in regard to street improvements, as was reported in our issue of last week.

MACON, GA.—It is proposed to pave Cherry St. with brick, at an estimated cost of $42,256. C. L. Patrick, Asst. Cy. Engr.

MERIDIAN, MISS.—N. M. Brandon, Cy. Engr., writes us that the city has voted to issue $105,000 in bonds for paving, plans for which have not yet been completed.

CINCINNATI, O.—Bids are asked until Oct. 29 for paving several streets with brick. A. P. Butterfield, Clk. Bd. Administration.

INDIANAPOLIS, IND.—Bids are asked until Oct. 12 for 15,000 sq. yds. of asphalt paving, 7,000 sq. yds. of broken stone, etc.; until Oct. 15 for 20,000 sq. ft. of cement sidewalks, and until Oct. 19 for 10,250 ft. of brick sidewalks. Chas. C. Brown, Cy. Engr.; J. H. Dean, Engr. Sts. and Surveys.

LAFAYETTE, IND.—Bids are asked until Oct. 28 for brick paving. W. K. Eldridge, Cy. Engr.——The city engineer writes us that the proposed 13,000 sq. yds. of macadam paving has been postponed until spring.

PEORIA, ILL.—Almon D. Thompson, Cy. Engr., writes us that the council will pass the ordinances for paving about 12 miles with brick and asphalt some time this month.

COUNCIL BLUFFS, IA.—The council has decided to pave Pearl and Story Sts. with brick.

LUMERTON, N. MEX.—The Boren Toll Road Co. has been incorporated with a capital stock of $1,000 by E. M. Biggs, William Boren and Frank E. Clark.

SEATTLE, WASH.—E. O. Schwagerl, Park Comr. and Landscape Arch., is urging the construction of a boulevard on the west shore of Lake Washington.

GARBAGE DISPOSAL.

POTTSVILLE, PA.—It is reported that this city contemplates the construction of a garbage crematory.

EVANSVILLE, IND.—Bids are asked until Oct. 26 for the construction of a garbage crematory; population, 60,000. E. E. Clarke, Clk. Bd. Pub. Wks.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

STONE CRUSHER.—Westchester, Pa.—It is reported that the borough will purchase a stone crusher at an early date.

FILLING.—Detroit, Mich.—Bids are asked until Oct. 19 for filling in river front at Fort Wayne, Mich. 1st Lieut. H. L. Roberts, A. A. Q. M., U. S. A.

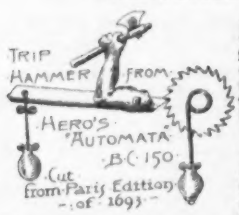
CANAL.—Baltimore, Md.—Bids are asked until Oct. 21 for constructing 30 miles of canal, including dams, locks, etc., as stated in our advertising columns. Lake Drummond Canal & Water Co., 21 South Gay St.

STATE CANAL WORK.—Albany, N. Y.—Bids are asked until Oct. 18 for piling and protecting the banks of the Shinnecock & Peconic Canal, and also for dredging a channel between Shinnecock Bay, Long Island, and the Atlantic Ocean, as stated in our advertising columns. George W. Aldridge, Supt. Pub. Wks.

PUMPING PLANT.—Brooklyn, N. Y.—Bids are asked until Oct. 23 for furnishing and erecting a centrifugal pumping plant for granite dry dock at the Brooklyn navy yard, as stated in our advertising columns. This plant will replace the old one which has been in service a long time. Address E. O. Matthews, Ch. of Bureau of Yards and Docks, Washington.

DRY DOCK.—Tlacotalpan, Mexico.—A report states that work was to have been commenced last week on a dry dock, located at this place, having a capacity for vessels of 1,500 tons. The contract for the work was recently awarded by the Mexican government to S. Pearson & Son, who have charge of the harbor work at Vera Cruz. Tlacotalpan is situated on the Papaloapan River in the southern part of the state of Vera Cruz.

MANUFACTURING PLANTS.



CHARLTON, MASS.—It is reported that Akers & Taylor will soon build an iron building, 100 × 60 ft., on the site of the Chapman mill, which was burned last year, to be used for the manufacture of warps.

NEWBURYPORT, MASS.—It is understood that a new company for the manufacture of street cars has been organized at this place, and that W. B. Ferguson, of the Milford & Framingham St. Ry. Co., Milford, Mass., is interested; capital stock, $25,000.

BRIGHTWOOD, MASS.—Lawton & Pratt's anchor and car axle shops have been burned; reported loss, $25,000.

WARREN, R. I.—The Warren Mfg. Co.'s plant was recently destroyed by fire; reported loss, $1,000,000; insurance, $850,000. A press report states that the company will rebuild, and that the new plant will be larger than the old one.

MIDDLETOWN, CONN.—The Worcester Cycle Co. has been in consultation with Isaac Spear, Pres. Business Men's Association, regarding the establishment of a plant in Middletown.

CARTHAGE, N. Y.—It is reported that the Brownville Paper Co. has purchased a water power on the Black River, five miles from Carthage, and propose to erect a large pulp and paper mill, at a cost of $150,000.

GLOVERSVILLE, N. Y.—A press report states that the contract for the new knitting mill building has been awarded to Alden L. Henry; that for the boiler to John Collins & Co., of Amsterdam, N. Y., and the engine contract to the Fishkill Landing machine works. The equipment will include an electric plant.

KINGSTON, N. Y.—It is reported that the Ulster & Delaware R. R. Co. will soon erect a new machine shop at this place.

LOCKPORT, N. Y.—It is understood that Henry & Cummings will soon rebuild their planing mill in East Lockport. The new structure will be of sheet iron.

NEW YORK, N. Y.—A press report states that Schenk & Schlichts will soon erect a six-story factory, at 22 and 24 Jones St., to be built of brick, terra cotta and iron; heated by steam from an independent plant, lighted by electricity, and equipped with freight elevators, sanitary plumbing and underground vaults.

RANDOLPH, N. Y.—The foundry and machine shops of S. J. Benedict, at East Randolph, were recently destroyed by fire; reported loss, $15,000 to $16,000; insurance, $7,000.

ROCHESTER, N. Y.—The buildings of the Rochester Vulcanite Pavement Co., on Alexander St., have been burned; reported loss, $30,000.

CAMDEN, N. J.—A press report states that the contract for the carpenter work on the five U. S. Sugar Refinery buildings, from Penn to Linden, and from Delaware St. to the river, has been awarded to H. S. Riggs, of Philadelphia, Pa. Leonard Foley & Co. have the contract for the ironwork, involving about $100,000.

NEW BRUNSWICK, N. J.—A correspondent writes us that the Walworth Run Foundry & Machine Works, of Cleveland, O., will immediately erect four buildings at this place, and will employ 100 men at the start and about 800 within a year. The company will need boilers, engines, machinery, etc.

BEAVER FALLS, PA.—It is reported that the foundry and machine shops of Harn, Orr & Co. were entirely destroyed by fire recently, causing a loss of $35,000.

ERIE, PA.—It is reported that new iron foundries will be built at this place this winter or early in the spring. C. M. Reed is interested.

McKEESPORT, PA.—The National Tube Works Co. is reported as having secured options on a number of properties between Sinclair & Huey Sts., with a view to enlarging its plant.

MEADVILLE, PA.—A news item states that the foundations for the Eagle Iron Works, which are to be removed to New Castle, will probably be built this fall. It is the intention to get the buildings up as early in the spring as possible. They will be built of structural iron.

NEW CASTLE, PA.—It is understood that the Elliott-Washington Steel Co., of this city, has purchased ground upon which an additional building will be erected. The company will put in two additional sets of rolls.

PHILADELPHIA, PA.—The four-story building at Broad and Noble Sts., owned and occupied by the Horn & Brannel Mfg. Co., manufacturers of gas and electrical fixtures, was recently burned; reported loss, $150,000. Also the lumber mill plant of Rufus R. Thomas & Co., at 19th St. and Washington Ave.; estimated loss, $150,000, covered by insurance.—The Sunlight Oil & Gasoline Co. has decided to rebuild the works recently reported burned at Gray's Ferry.—It is reported that extensive additions are planned by the Wilbraham Co. Two new buildings are to be erected, both designated as pattern shops, 63 × 100 ft. and 70 × 70 ft.—A press report states that the John T. Lewis Bros. & Co. will add a new structure to its white lead works, 41 × 134 ft., and three stories high.

PITTSBURG, PA.—Press reports state that the Monongahela Plate Glass Co. will erect four principal buildings at Point Marion, Pa., which will cover 200 × 600 ft. of ground. The polishing and grinding rooms will be 100 × 200 ft., and the casting hall 60 × 100 ft. It is probable electric motors will be used in running the grinders and polishers. Secy., H. L. Dixon, Pittsburg.

MARTINSBURG, W. VA.—A new addition now being made to the Crawford woollen mills at this place will need equipment in a few weeks, which will include 14 looms, new engines, boilers, etc. Address P. L. Dunn, Manager.

BIG ISLAND, N. C.—R. R. Haynes and associates will build a large cotton mill on Broad River at this place, which is located near Rutherfordton, N. C.

BLACK MOUNTAIN, N. C.—A large saw and planing mill plant will be put up near this place by N. B. Patterson and associates, of Detroit, Mich. Address Mr. Patterson at Black Mountain, or at Asheville, N. C. He will let contract for all machinery.

CHARLOTTE, N. C.—The Charlotte Cotton Mills Co. will add new machinery to its weaving department at once.

GREENSBORO, N. C.—The Crown cotton mills at this place are to be renovated and new machinery put in, including engines and boilers and probably an electric light plant. The mill has not been opened for two or three years, on account of litigation over the property, now ended.

NEWTON, N. C.—The Newton Cotton Mills Co. has decided to put in 10,000 new spindles and a new Corliss engine.

ANDERSON, S. C.—The Anderson Cotton Mill Co., of this place, has decided to double the capacity of the present plant. The additions, buildings and machinery will cost $300,000.

CHARLESTON, S. C.—C. J. Memminger and associates will build and equip a thread mill at this place at an early date.

DARLINGTON, S. C.—It is reported that the Darlington Iron Works, recently formed by W. J. Farly, will erect a foundry, with blast furnace of 2,000 lbs. capacity.

CROSS HILL, S. C.—John G. Williams and associates are organizing a company to build a cotton mill at this place.

LA GRANGE, GA.—A 100 × 400-ft., 15,000-spindle cotton mill will be erected and equipped at this place at once by the Dixie Cotton Mills Co., just formed, with J. G. Truitt, president, and Samuel Hale, secretary and treasurer. The plant will include an electric light plant.

TALLEDEGA, ALA.—A company is being formed at this place to erect and equip a knitting mill.

MERIDIAN, MISS.—The Interstate Iron Works were recently destroyed by fire; reported loss, $30,000; insured.

LOUISVILLE, KY.—Press reports state that a carriage factory and repository will be erected on First St., between Market and Jefferson. The building will be four stories, 104 × 104 ft., is to be built of brick, stone and iron, and to be equipped with machinery, elevators, etc.

FOSTORIA, O.—It is reported that John B. Hasting, inventor of a secret process of making steel, desires to locate a steel plant in this place, and will do so if a loan of $10,000 can be raised. Two brick buildings 100 × 40 ft. will be erected.

NEWARK, O.—A. H. Heisey will build a new glass factory; iron and brick; estimated cost, $75,000. Arch., O. T. D. Evans, Pittsburg, Pa.

ANDERSON, IND.—It is said that the Colver Boiler & Locomotive Works, of New York, will locate in this city, provided a $60,000 subsidy is raised by the sale of lots. Half of the amount has so far been raised, and the remainder, it is expected, will be early in October.

ELWOOD, IND.—A press report states that the new steel plant recently located at Orestes, near this place, to manufacture steel billets, will be erected this fall. The buildings are to be of iron and steel and fireproof.

MIDDLETOWN, IND.—The Irondale tin-plate plant of this place is reported as soon to be enlarged.

DETROIT, MICH.—It is reported that the Michigan Bolt & Nut Works has had plans prepared for a two-story factory, 75 × 150 ft., to cost $17,000.

CHICAGO, ILL.—The Chicago Pressed Steel Co. was recently incorporated with a capital stock of $500,000, to manufacture steel ties. A press report states that the company will locate its plant at Chicago Heights, and that it will have a capacity of 250 tons daily. The mill will be 320 × 75 ft. James W. Wilson, 215 Madison St. John M. Horn and Edward L. Lamb are the incorporators.—It is reported that plans have been prepared by F. J. Norton, Masonic Temple, for the erection of a $75,000 factory on Bloomfield Ave. and Humboldt Boulevard.

ROCKFORD, ILL.—The factory of the Rockford Cabinet Co. was recently destroyed by fire; reported loss, nearly $80,000; insurance, $35,000. The factory will probably be rebuilt.

RACINE, WIS.—It is reported that the Belle City Iron Co. will expend $75,000 in improving its plant. John T. Lewellyn, Man.

GOODHUE, MINN.—Eleven buildings, including Sheldon & Co.'s elevator, a hotel and Patrick Kelly's machine shop, have been destroyed by fire; reported loss, $40,000; insurance $10,000.

ST. PAUL, MINN.—A press report states that the Columbia Car Mfg. Works, recently organized, has purchased a site at Baden. Plans for the plant are now in the hands of the architect, and work on the building will begin in a few weeks. It is expected to be in operation by Jan. 1, and that the works will give employment to 1,000 hands or more.

KANSAS CITY, MO.—It is reported that a factory for the manufacture of strawboard on an extensive scale will be established in the stock yard district, plans now being in preparation for the building. Some 500 men will be employed. The Armour Packing Co. and other packers are interested.

ST. LOUIS, MO.—It is reported that Julian T. Zollar has prepared plans for 10 factory buildings for the Whitman Agricultural Co., 121 South Eighth St., to be fireproof, have architectural ironwork, iron shutters, electric lighting, feed-water heaters, forges, engines and boilers, etc., to cost $75,000.

GOLDEN, COLO.—The Golden brewery plant, a report states, will be enlarged, the new structure will be six stories, 40 × 115 ft. Adolph Coors, Man.

WALLACE, WASH.—The Coeur d'Alene Iron Works, two miles above this town, were recently destroyed by fire; reported loss, $20,000. Farrell & Thompson, owners. The plant will probably be rebuilt.

CONTRACT PRICES.

GRANITE BLOCK PAVING.—Albany N. Y.—Bids were opened Oct. 7 for paving in three streets with granite blocks, the contracts being awarded to the Callanan Road Improvement Co., 51 State St., Albany, at $14,600 and $15,546, and to T. Henry Dumary, of Albany, at $12,900. The bids were as follows, all the bidders being residents of Albany:

Quantities.	P. Mulderry, $14,511.	T. H. Dumary, $12,900.	Wm. P. Reynolds, $15,948.	E. F. Dillon, $13,678.	Callanan Rd. Improv. Co., $13,106
Canal St.:					
Granite pavement, sq. yd.	$2.95	$2.79	$2.90	$2.79	$2.66
Straight granite curb	1.00	.50	.85	.85	.70
Circular granite curb	1.15	.50	.85	.85	.70
Crosswalks	.25	.15	.20	.27	.18
Relaying on sand	.25	.30	.10	.25	.25
Relaying curbstones	.08	.30	.10	.25	.20
New brick sidewalk, sq. ft.	.06	.06	.06	.07	.08
New 5-ft. flag sidewlk, sq. ft.	.16	.15	.15	.14	.16
Relaying sidewalk, sq. ft.	.03	.03	.03	.04	.04
Days to complete, $5 pr day	30	20	28	30	20

Quantities.	B. & P. W. Mulderry, $16,578.	T. H. Dumary, $15,557.	Wm. P. Reynolds, $16,446.	C. H. Flanagan, $15,777.	Callanan Rd. Improv. Co., $15,546
Clinton St.:					
Granite pavement, sq. yd.	$2.79	$2.79	$2.82	$2.65	$2.66
Straight granite curb	.86	.50	.85	.82	.70
Circular granite curb	.86	.50	.85	.82	.70
Crosswalks	.20	.15	.15	.20	.15
Relay'g pavem't in concrete	.90	1.50	.70	.58	1.00
Relaying pavement on sand	.28	.40	.10	.20	.25
Relaying curb	.06	.30	.10	.07	.08
Brick sidewalk	.05½	.06	.06	.06	.08
Flag sidewalk	.11	.15	.14	.13	.15
Relaying sidewalk	.03	.03	.03	.03	.06
Receiving basins	70.00	70.00	70.00	70.00	70.00
Days to complete, $5 pr day	42	20	30	30	20

Quantities.	R. & P. W. Mulderry, $15,721.	T. H. Dumary, $14,748.	C. H. Flanagan, $15,965.	Wm. P. Reynolds, $15,604.	E. F. Dillon, $15,210.	Callanan Rd. Improv. Co., $14,670
South Ferry St.:						
Granite pavement	$2.81	$2.81	$2.65	$2.82	$2.70	$2.66
Straight granite curb	.85	.50	.82	.85	.70	.70
Circular granite curb	.90	.50	.82	.85	.70	.70
Crosswalks	.20	.15	.82	.15	.27	.18
Relaying on sand	.25	.30	.20	.20	.27	.25
Relaying on concrete	.85	1.50	.58	1.20	1.00	1.00
New brick sidewalk	.05	.06	.06	.05	.07	.08
New flag sidewalk	.14	.15	.14	.13	.15	.15
Relaying sidewalk	.28	.03	.12	.10	.27	.05
Receiving basins	70.00	70.00	70.00	75.00	75.00	80.00
Extra concrete, cu. yd.	4.25	4.00	4.00	4.00	4.50	4.00
Days to complete*	42	20	30	30	45	20
Relaying curb stone	.06	.30	.07	.15	.25	.20

* At $5 per day.

CANAL.—Port Huron, Mich.—The following bids were received Oct. 1 for constructing a canal from Lake Huron to Black River, as advertised in Engineering News; water channel to be 6 ft. deep by 40 ft. wide, with an average depth of cut of about 25 ft.; distance from lake to river by two routes, about 6,700 ft. and 7,390 ft., respectively; F. F. Rogers, Cy. Engr.; Henry Kaumeier, Supt. Pub. Wks.:

Geo. Lockerbie, Detroit, Mich., either route, $450,000. This includes breakwater and protecting sides of canal entire length.

John M. Lally, Wellston, O., route No. 1, $156,000; route No. 2, $163,000.

C. E. Mitchell & Co., Ludington, Mich., No. 1, $163,000; No. 2, $200,000. This includes breakwater.

Pollard, Goff & Co., Port Huron, Mich.—Route No. 1, with guaranty, $132,500; without guaranty, $105,500; No. 2, with guaranty, $140,000; without guaranty, $113,000.

R. H. McWilliams & Co., Chicago, Ill.—Route No. 1, with guaranty, $127,333; without guaranty, $97,333; No. 2, with guaranty, $132,957; without guaranty, $104,733.

Casgrain & McDonald, Chicago, Ill.—Route No. 1 (544,530 cu. yds. at 17½ cts.), $95,293; route No. 2 (531,615 cu. yds. at 17½ cts.), $93,033. The above includes breakwater.

M. Lally, Detroit, Mich.—No guaranty. Route No. 1 (544,530 cu. yds. at 16 cts.; clearing, $60 per acre), $89,985; No. 2 (531,615 cu. yds. at 17 cts.; clearing, $60 per acre), $92,775.

CONCRETE WALL.—Philadelphia, Pa.—The following bids were received Oct. 8 for a concrete footing course for the inner slope of the leaky Queen Lane reservoir, the price being per cubic yard:

Bidder.	Excavation.	Concrete.	Time specified.
Jones, Pollard & Co.	$2.75	$8.95	3 months.
M. McManus	0.57	7.35	2 "
Pepper & Register	0.90	9.23	40 days
H. C. Ayer	0.97	9.35	6 months.
Penn. Asphalt Paving Co.*	0.40	5.50	20 days.
Am. Pav. & Cons. Co.	0.75	9.00	60 "
R. E. Malone & Co.	1.50	8.00	Dec. 25.
P. McManus	0.95	5.95	90 days
I. H. Hathaway & Co.	0.85	7.65	50 "
American Asphalt Co.	0.87	8.00	60 "
Joseph R. Smith	1.08	7.85	23 "
J. W. Hoffman & Co.	0.95	6.50	Jan. 1.

* Awarded contract.

GRADING.—Boston, Mass.—The following bids were received by Chas. Mills, Ch. Engr. Massachusetts Highway Comn., 15 Court Square, Sept. 24, for grading a road in Norfolk, Mass.:

Quantities.	C. McDermott, Brockton, Mass.	R. Floram, Franklin.	J. McGovern, 895 Adams St., Dorchester, Mass.	A. Carberry, E. Walpole, Mass.	Hendrick, Taylor & Warner, Northampton, Mass.
Excavation	$0.38	$0.39	$0.37	$0.28	$0.28
Dry rubble masonry	5.00	3.00	2.75	4.00	5.00
Cement rubble masonry	6.00	5.00	3.00	5.50	6.00
12-in. vitrified clay pipe	1.00	.60	.50	.75	.60
Guard rail	.16	.15	.20	.22	.20
Setting stone monuments	2.00	1.25	1.50	1.25	1.25
Total	$3,602	$3,412	$3,298	$3,038	$3,036

BRICK PAVING.—Pontiac, Ill.—At the last meeting of the city council the following bids were opened for paving with brick, the contract being awarded to the Talbot Paving Co.: Talbot Paving Co., Detroit, Mich., $1.09 per sq. yd. for paving; excavating, 15 cts. per cu. yd; filling, 5 cts. per cu. yd.; curbing, 48 cts. per lin. ft. Dubuque Paving Co., $1.20 for paving, 20 cts. for excavating, 20 cts. for filling, and 50 cts. for curbing; White & Valentine, Chicago, $1.52 for paving, 40 cts. for excavating, 40 cts. for filling, 42 to 60 cts. for curbing; John Cherry, Jr., Jacksonville, Ill., $1.20 for paving, 16 cts. for excavating, 15 cts. for filling, 44 cts. for curbing; R. F. Kincaid & Co., Decatur, Ill., $1.52 for paving, 10 cts. for excavating, 5 cts. for filling, 35 cts. for curbing; Campbell & Dennis, Joliet Ill., $1.22 for paving, 30 cts. for excavating, 30 cts. for filling, 45 cts. for curbing. We are informed by G. L. Bigelow that the paving is to be of Streator brick for top course, upon 4 ins. of sand, well rolled, and one layer of vitrified brick laid on side. The Talbot Paving Co. has begun work.

WATER-WORKS.—Bond Hill, O.—Geo. Hornung, Consult. Engr., 238 East Fourth St., Cincinnati, writes us that the following bids were received Sept. 30 for constructing water-works at this place, as advertised in Engineering News, contracts being awarded to John Ryan and M. H. Fink for pipelaying, at $2,661; to the Anniston Pipe & Foundry Co., for pipe, at $9,718, and to the Bourbon Copper & Brass Works for valves and hydrants, at $2,004:

Bidder.	8-in. pipe, 5,965 ft.	6-in. pipe, 6,005 ft.	4-in. pipe, 11,250 ft.	Setting 40 hydrants.
Pipelaying:				
J. Ryan & M. H. Link, Reading, O.	$0.135	$0.115	$0.10	$1.50
Jacob Glos, Bond Hill, O.	.13	.12	.115	3.00
Caruthers & Crane, Newport, Ky.	.165	.145	.12	2.75
John Story, Cincinnati, O.	.25	.20	.16	17.15
John Schneider, Norwood, O.	.15	.125	.09	.80
Schneider & Williams, Dayton, O.	.165	.135	.105	....
Van Sandt & Meeds, Cincinnati, O.	.1820	.155	.12	5.00
Geo. W. Young & Co., St. Bernard, O.	.18	.14	.1075	.90
Morton & Air, Newport, Ky.	.169	.149	.129	4.00

Bidder.	8-in. pipe, 123 tons.	6-in. pipe, 122 tons.	4-in. pipe, 128 tons.	Specials, 6 tons.
Pipe and special castings:				
Howard-Harrison Pipe Co.	$25.50	$25.50	$25.50	$50.00
Addyston P. & S. Co., Cincinnati	25.96	25.96	25.96	50.00
So. Pittsburg Pipe Co., S. Pittsburg	25.69	25.69	25.69	52.50
Anniston P. & F'dry Co., Anniston, Ala	25.25	25.25	25.25	50.00

Bidder.	Fire hydrants, 40.	8-in. valves, 5.	6-in. valves, 40.	4-in. valves, 46.	Extension blv. boxes, 91.
Hydrants and valves:					
Bourbon C. & B. Wks., Cincinnati	$27.50	$14.00	$9.00	$5.75	$2.30
J. Flower & Bros., Detroit, Mich.	19.00	14.25	9.10	5.85	2.50
The Chas. Barnes Co., Cincinnati,	20.00	14.50	9.75	6.25	2.20
Queen City B. & I. Wks "	30.00	15.00	9.60	6.00	2.30

MACADAMIZING.—Bristol, Conn.—Wm. R. Strong, First Selectman, writes us that the contract for 2,515 lin. ft. of macadamizing in Riverside Ave. has been awarded to Lesher & Condon, of Bristol, at $2.46 per cu. yd. for crushed stone in place, 20 cts. per cu. yd. for earthwork, haul of 700 ft.; 2 cts. per 100 ft. for haul of over 700 ft.; $3 per cu. yd. for rock excavation. Fred T. Ley, of Springfield, Mass., and John A. Doolittle & Co., of New Haven, Conn., were the other bidders.

SEWERS.—Port Huron, Mich.—F. F. Rogers, Cy. Engr., writes us that a contract for 21,000 ft. of pipe sewers has been awarded to J. G. Muir, at 84 cts., 55 cts., 46 cts., 39 cts., 34 cts. and 30 cts. per lin. ft., respectively, for 24-in., 18-in., 15-in., 12-in., 10-in., and 8-in. pipe sewer; 27 manholes, $20 each; 40 wood catchbasins, $9 each; 910 house connections, $315.75; 6 flush tanks, $70 each; total, $9,389. The other total bids were as follows, all the bidders being residents of Port Huron: W. W. Carlisle, $12,813; J. Denler & Co., $12,037; Jenkinson Nicholson & Co., $10,652; De Loyia & Doe, $10,165; McMahon & Sharp, $9,830.

SEWERS.—Albany, N. Y.—The contract for a vitrified pipe sewer in High St. has been awarded to John Doyle. The bids were opened Oct. 7, and were as follows:

Quantities.		John Doyle.	Edward F. Dillon.
15-in. extra heavy vit. pipe	625 ft.	$1.24	$1.25
12-in. vitrified pipe	496 "	1.04	1.05
6-in. vitrified pipe	1,050 "	.12	.14
15-in. Y's	33	3.57	3.75
12-in. Y's	47	2.68	2.73
Manholes	4	40.00	45.00
Lampholes	2	12.50	15.00
Receiving basins	5	70.00	75.00
Alley receiving basins	2	70.00	65.00
Lateral trenches	1,050 ft.	.40	.50
House drain trenches	215 "	.40	.40
6-in. bends	156	.30	.40
Reducers:			
6 x 8-in. or 6 x 10-in.	30	.80	.80
Total		$2,912	$3,114

BELGIAN BLOCK PAVING.—Jersey City, N. J.—The following bids were received for the improvement of Oakland Ave., from Hoboken Ave. to Prospect St.:

Bids Received at Jersey City, N. J., for Improving Oakland Ave.

Quantities.	Thomas Harrington.	Sheridan & Shea Co.	Patrick H. Flaherty, Jr., & Co.	Denis Byrnes.	Thos. Cavanagh.	Edw. O'Neil.	Philip Tuohy.	Geo. Kelss.	Edward O'Donnell.	P. T. Plunkett.	Bernard Feeney.
Earth excavation per cu. yd.	$0.30	$0.10	$0.15	$0.17	$0.01	$0.25	$0.35	$0.25	$0.01	$0.25	$0.05
Rock excavation " " "	.01	.01	.01	.01	.01	.01	.25	10.00	.01	3.00	.10
Sand or gravel filling	1.00	.60	.90	.90	1.00	1.00	1.00	1.00	.00½	.01	.10
Belgian block paving per sq. yd.	1.05	1.11	1.14	1.15	1.25	1.25	1.30	1.35	1.41	1.40	1.50
New curbstone per lin. ft.	.40	.45	.44	.05	.22	.45	.45	.43	.00½	.40	.05
New bridge stone per sq. ft.	.30	.45	.38	.45	.39	.40	.40	.50	.45	.50	.50
Repaving per sq. yd.	.10	.10	.05	.15	.07	.20	.20	.25	.01	.01	.02
Resetting curbstone per sq. ft.	.05	.05	.04	.07	.07	.10	.03	.05	.05	.05	.06
Relaying bridge stone " " "	.05	.04	.04	.04	.02	.10	.03	.05	.05	.05	.05
Cribbing per lin. ft.	.10	.10	.01	.20	.00	.10	.25	.30	.10	.10	.25
Resetting receiving basins each,	5.00	3.00	1.00	8.00	1.00	8.00	5.00	2.00	5.00	10.00	10.00
Manhole heads br'ght to grade, each,	1.00	.50	.50	.75	1.00	2.00	.50	1.00	.50	.01	1.00

RESERVOIRS.—Colorado Springs, Colo.—The awarding of contracts to Ord & Swope for constructing reservoirs was noted last week under Water-Works. Chas. E. Smith, Cy. Clk., writes us that the bids were as follows, all the bidders being residents of this city:

Quantities.		Richard Clough.	Atkinson Bros. & Co.	Ord & Swope.
Reservoir No. 8.				
Earthwork	30,000 cu. yds.	$0.54	$0.44¾	$0.44
Loose rock	13,000 " "	.80	.75	.44
Masonry	45 " "	6.50	6.00	6.85
Concrete	30 " "	8.00	9.00	7.50
Paving	6,000 sq. "	.60	.65	.60
18-in. iron pipe	120 lin. ft.	3.80	3.55	3.50
18-in. valve	1	50.00	48.00	100.00
Total		$31,238	$28,089	$23,573
Reservoir No. 7.				
Earthwork	32,000 cu. yds.	$0.54	$0.45	$0.35
Masonry	40 " "	7.00	6.00	6.50
Concrete	30 " "	8.00	9.00	6.50
Paving	5,000 sq. "	.60	.65	.60
16-in. iron pipe	120 lin. ft.	4.00	3.55	3.25
16-in. valve	1	50.00	45.00	95.00
Total		$21,330	$18,631	$15,140

GUN FORGINGS.—Washington, D. C.—The following bids were received Oct. 3 by the chief of bureau of ordnance, navy department, for steel gun forgings: 27 sets 4-in. forgings—Midvale Steel Co., Nicetown, Pa., 28½ cts. per lb.; Bethlehem Iron Works Co., Bethlehem, Pa., 29 cts. 13 sets 5-in. forgings—Midvale Steel Co., 30 cts.; Bethlehem Iron Co., 29 cts.

SEWERS.—Greenfield, Ind.—W. J. Cleary, Cy. Engr., writes us that the following bids were received Sept. 20 for constructing 13,245 ft. of pipe sewers:

Bids Received at Greenfield, Ind., Sept. 20, for Constructing Pipe Sewers.

Bidders.	18-in., av. cut, 4.5 ft.	15-in., av. cut, 2.45 ft.	12-in., av. cut, 11.6 ft.	10-in., av. cut, 11.7 ft.	8-in., av. cut, 9.8 ft.	6-in., av. cut, 10.7 ft.	Manholes, 19, each.	Lampholes, 5, each.	Flush tanks, 3, each.	Masonry, per cu. yd.	Total.
Malden & Fink, Goshen, Ind.	$0.53	$0.40	$0.60	$0.57	$0.49	$0.44	$30.00	$10.00	$65.00	.....	$7,,67
C. M. Kirkpatrick, Greenfield, Ind.	.75	.75	.75	.95	.75	.75	31.00	25.00	65.00	.....	10,785
Porter, Bowlin & Hadley, Tipton, Ind.	1.145	.84	1.09	.97	.885	.72½	35.00	12.50	65.00	.....	13,910
Gansberg & Roney, Indianapolis, Ind.	.95	1.10	.85	.79	.64	.57	35.00	12.00	95.00	$4.00	11,038
Fries & Barr, Greenfield, Ind.	.66	.412	.744	.485	.352	.382	30.00	5.00	65.00	8.00	8,009
Daniel Sullivan, Kokomo, Ind.	.75	.60	.62	.59	.46	.38	22.00	12.00	55.00	7.50	8,371
Ulrich, Nissley & Williams, Sp'gf'd, O.	.60	.50	.60	.55	.50	.47	25.00	10.00	75.00	12.00	8,253
N. Matthews & Co., Indianapolis, Ind.	.54	.49	.56	.48	.43	.38	25.00	8.00	65.00	6.00	7,279
Charles Daniels, Anderson, Ind.	.62	.55	.55	.43	.39	.37	30.00	8.00	65.00	4.00	7,414
Parker, Fry & Parker, Greenfield, Ind.	.68	.58	.89	.94	.74	.68	29.00	10.00	70.00	12.00	11,020

WATER-WORKS.—Laurens, N. Y.—E. F. Musson, Engr., Norwich, N. Y., writes us that the contract for constructing water-works, as advertised in Engineering News, has been awarded to Flood & Sherrill, of Sandy Hill, N. Y., at $6,433. The bids ranged as follows: 6-in. cast iron pipe, $21.50 to $23.50 a ton; 4-in., $22.04 to $24.03; 2½-in. wrought iron pipe, 21½ cts. to 23.9 cts.; 2-in. galvanized, 14½ cts. to 16.8 cts.; special castings, 2¼ cts. to 2⅝ cts. (13 bidders); 6-in. valves, $10.50 to $12.32; 4-in., $6.10 to $7.82; 2½-in., $3.60 to $6; valve boxes, $2.50 to $3.50; hydrants, $21.13 to $26.07; ball and socket joints, $11 to $12.10. The bids for pipelaying were as follows:

Items.	O'Connor & Co.	Flood & Sherrill.	John Morrell.	White & Edie.	Munson & Lewis.	J. J. Sprigat.	H. S. Eveline.
Layings:							
6-in. pipe	$0.17	$0.15	$0.15	$0.14	$0.18⅝	$0.17	$0.16½
4-in. "	0.14	0.14	0.14	0.13	0.17 3-10	0.16	0.15
2½-in. "	0.07	0.08	0.09	0.06	0.10	0.10	0.08
2-in. "	0.07	0.08	0.08	0.06	0.11	0.10	0.08
Rock exca.	6.50	3.00	2.50	2.50	1.00	2.50	2.50
Earth "	0.30	0.23	0.28	0.25	0.24 6-10	0.30	0.27
Rub. mas.	4.50	3.40	6.00	4.25	4.00	5.00	4.75
Concrete	4.50	4.50	6.00	4.50	4.00	3.00	4.50

CAST IRON PIPE.—Troy, N. Y.—The water commissioners have awarded a contract for 2,500 ft. of 12-in. cast iron pipe, 90 lbs. to the foot, to R. D. Wood & Co., at $21.65 a ton, delivered by boat.

BOILERS.—Newport, Ky.—The following bids were received for two 72-in. steam boilers, with 26 6-in. tubes, riveted to heads, 20 ft. long, all set up at the water-works, with furnaces and stacks and everything complete ready for use:

Tudor Boiler Works, Cincinnati	$3,849
Robert Jones & Co., Cincinnati	3,778
McElvane & Spiegel, Cincinnati	3,720

PIG LEAD.—Buffalo, N. Y.—The board of public works has opened the following bids for 100 tons of pig lead for the water department: D. Ullman's Sons, $6,610; Benjamin Iron & Steel Co., $6,635.50; Oppenheimer, Hoffeller & Co., $6,599; N. Corwith, $6,550; George P. Horton, $6,450; Charles F. Mensch, $6,940. All the bidders are Buffalo men.

LAYING WATER MAINS.—Elmwood, Ill.—Z. L. Gilbert, Cy. Clk., writes us that the contract for laying about three miles of water mains, as advertised in Engineering News, has been awarded to B. O. Krotter, of Knoxville, Ill., at 24 cts., 20 cts., 17 cts. and 15 cts., per lin. ft., respectively, for 10-in., 8-in., 6-in., and 4-in. pipe.

METAL MARKET PRICES.

LEAD.—New York: 3.3 to 3.35 cts. Chicago: 3.12 to 3.15 cts. St. Louis: 3.05 to 3.1 cts.

BARB WIRE.—Pittsburg: $2.70 and $2.80 for galvanized, and $2.30 and $2.40 for painted in carload and less than carload lots at mill.

FOUNDRY AND PIG IRON.—New York: $12 to $14.50. Pittsburg: $13 to $15. Chicago: $13.50 to $15.

TRACK MATERIAL.—New York: angle bars, 1.4 to 1.5 cts.; spikes, 1.8 to 1.85 cts.; track bolts, 2 to 2.2 cts. with square, and 2.1 to 2.2 cts. with hexagon nuts. Chicago: angle bars, 1.75 to 1.8 cts.; spikes, 1.9 to 2 cts.; track bolts, 2.3 to 2.45 cts. with square and 2.5 to 2.65 cts. with hexagon nuts.

NAILS.—Pittsburg: $2.25 per keg for carload lots and $2.35 for less than carload lots, for wire nails at mill; $1.80 and $1.85 for cut nails at mill. Chicago: $2.40 and $2.50 for wire nails, $2 and $2.05 for cut nails. New York: $2.40 and $2.50 for wire nails, and $1.95 and $2.05 for cut nails.

RAILS.—New York: $28 at eastern mills and $28.75 at tidewater; old rails, $17 to $18 for iron, and $13.50 to $14 for steel; light rails, $26 to $28; girder rails, $26. Pittsburg, $28 for standard sections of 45 lbs. and over; $28 for light sections; old rails, $19.75 for iron and $17 for steel. Chicago: $29 to $31 for standard sections; $28 for light sections; old rails, $17.50 to $19 for iron, and $14 to $15 for steel.——The mills decline to quote prices for rails for next year's delivery.

STRUCTURAL MATERIAL.—New York: beams, 1.85 to 2.1 cts.; channels, 1.85 to 2 cts.; angles 1.8 to 1.9 cts.; tees, 1.9 to 2 cts.; universal mill plates, 1.9 to 1.95 cts.; steel plates, 1.95 to 2 cts. for tank, 2 to 2.1 cts. for shell, 2.1 to 2.25 cts. for flange, 2.4 to 2.5 cts. for ordinary firebox, 2.6 to 2.75 for locomotive firebox. Pittsburg: beams, 1.6 to 2 cts.; channels, 1.6 to 2 cts.; angles, 1.5 to 1.6 cts.; tees, 1.6 to 1.7 cts.; Z-bars, 1.6 to 1.7 cts.; universal mill plates, 1.8 to 2 cts.; steel plates, 1.8 to 1.9 cts. for tank, 1.9 to 2 cts. for shell, 2 to 2.1 cts. for flange, 2.5 cts. for ordinary firebox, 2.5 to 4 cts. for locomotive firebox. Chicago: beams, 1.75 to 1.9 cts.; channels, 1.75 to 1.9 cts.; angles, 1.75 to 1.85 cts.; tees, 1.95 to 2 cts.; universal mill plates, 2.15 to 2.25 cts.; steel plates, 2.1 to 2.3 cts. for tank, 2.35 to 2.5 cts. for flange, 2.8 to 2.9 cts. for ordinary firebox, 4.5 to 4.75 cts. for locomotive firebox.

INDUSTRIAL NOTES.

THE KELLY & JONES CO., of Pittsburg, Pa., has just shipped a carload of steam pipe fittings to South Africa.

THE PACIFIC PAVING CO., of Portland, Ore., is reported as having recently failed, and John Hahn has been appointed receiver.

THE MICHIGAN PENINSULAR CAR CO., of Detroit, Mich., has received an order for 500 box cars from the Omaha & St. Louis Ry.

THE WORCESTER FOUNDRY CO., of Worcester, Mass., a press report states, has leased the Rice, Barton & Fales foundry, and will soon be ready for business.

THE UNION FOUNDRY & MACHINE CO., of Pittsburg, Pa., furnished the machinery for the new tin plate plant of the Stickney Iron Co., of Baltimore, Md.

THE BABCOCK & WILCOX CO., of Pittsburg, Pa., has a contract for 500-HP. boilers to be installed in the plant of the Westinghouse Machine Co. at East Pittsburg.

THE STANDARD ELECTRIC CO., of Chicago, Ill., is installing several municipal electric lighting plants, using its system of standard arc lights, including seven plants in the state of Ohio.

THE PETERSBURG IRON WORKS CO., of Petersburg, Va., has just secured the contract for furnishing to the Roanoke Mills, at Roanoke Rapids, N. C., 300 ft. of steel flume, 7 ft. 9 ins. in diameter.

THE BERGEN MFG. CO., of Canton, O., is erecting a building, 250 x 52 ft., to be used as a galvanizing department. The company is reported as having already placed contracts for machinery.

THE QUEEN CITY SCRAP IRON CO., of Denver,

Colo., has recently put into operation, according to press reports, a new rolling mill. The daily product is at present 22 tons of flats and rounds.

THE LEWIS CAR CO., of Brooklyn, N. Y., is said to have purchased the Fowler Car Works, at Elizabeth, N. J., and will at once take steps to reopen the extensive plant. Several hundred men will be empoyed.

THE AMERICAN STEEL BARGE CO., of West Superior, Wis., is planning to build two whaleback vessels this winter; one a steamer and the other a barge. They will be 380 ft. long, 45 ft. beam, and 26 ft. molded depth.

WILLIAM TOD & CO., of Youngstown, O., have been awarded the contract for furnishing that city two 5,000,000-gallon pumping engines. The detailed bids for this work were published under Contract Prices last week.

THE AMERICAN RAILWAY ELECTRIC LIGHT CO., of New York city, has equipped the Pullman car "Mabel," with its system of lighting. The car runs on the Pennsylvania R. R., between Jersey City and Philadelphia.

THE NATIONAL TUBE WORKS CO., of McKeesport, Pa., recently filled a large order for wrought iron pipe from the South African mining districts. It is stated that the company has recently exported pipe to London.

THE SERGEANT LEAD SMELTERY, of Joplin, Mo., is said to be actively pushing its buildings and works to completion. Several switches and spurs are being constructed by the Kansas City, Fort Scott & Memphis Ry. around the buildings.

THE W. C. LEFFEL WATER WHEEL CO., of Springfield, O., has been reorganized under the name of the Trump Manufacturing Co. Trump's new water wheel will be put into the market, and the manufacture of water wheels and engines will be continued.

THE YOUGH STEAM PUMP WORKS, of Connellsville, Pa., Boyts, Porter & Co., proprietors, among recent shipments report pumps sent to the Milner Coal & Railway Co., New Castle, Ala.; Rend Coal Co., Pittsburg, Pa.; H. C. Frick Coke Co., Laughlin & Co. and McClure Coke Co.

THE FILER & STOWELL CO., of Milwaukee, Wis., is said to have secured contracts for three engines for the Illinois Steel Co., one to be 36×46 ins., with a 60,000-lb. flywheel; another 36×60 ins., with a flywheel weighing 80,000 lbs., while the third is 42×60 ins., with a flywheel weighing 100,000 lbs.

THE ALABAMA ROLLING MILL, of Gate City, Ala., is reported as filling an order for 500 tons of rails to be used in the construction of a railway in one of the South American countries. The same company has just finished an order for 300 tons of finished iron for an Australian firm, which was shipped a few days ago.

THE CHICAGO SHIPBUILDING CO., Chicago, Ill., a report states, is building a 375-ft. steamer for the Wilson Transit Co., of Cleveland; capacity, 4,500 tons; cost, $240,000; two tow barges for the Minnesota Steamship Co., of Cleveland; capacity, 7,000 tons; cost, $180,000; a barge for the Northwestern Transportation Co., of Cleveland; capacity, 3,500 tons; cost, $90,000.

THE SAFETY CAR HEATING & LIGHTING CO., of New York, N. Y., writes us that Pintsch lighting equipment is being applied by the Atchison, Topeka & Santa Fe R. R. to 25 of its passenger coaches running on the Chicago and California line. The company has adopted the Pintsch light as its standard, and will apply it to all of its passenger coaches as rapidly as possible.

JOHN PLATT, 103 Cedar St., New York, has been appointed by John I. Thornycroft & Co., Chiswick, London, England, as their agent in this country, and particular attention will be paid by him to developing and pushing their well-known water-tube boilers, for land and marine service, and he will grant licences for the construction and use of boilers under its patents.

THE KEITH MFG. CO., of Sagamore, Mass., is building 100 coal cars, 34 ft. long, of 60,000 lbs. capacity, for the New York, New Haven & Hartford R. R. They are equipped with the Fox pressed steel trucks, Trojan automatic couplers, Westinghouse brakes, and the National hollow brakebeam. The company has also built 100 box cars of similar size and capacity for the same road.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has just completed for the town of Hadley, N. Y., a bridge 300 ft. long and 16 ft. wide. The company has also lately completed a new store room for the Hartford Rubber Works, a new car house for the Norwalk Tramway Co., at South Norwalk, Conn., and also a new generator house for the Burlington Gas Light Co., at Burlington, Vt. Work is reported very brisk in all departments.

THE CONTRACTORS' ESTIMATING CO., of Springfield, Mass., has been organized by E. B. Jennings, C. E., formerly of the R. F. Hawkins Bridge Works, for the purpose of furnishing contractors with guaranteed estimates of quantities for buildings, dams, bridges and public works generally. The company states that its prices are less than 0.1%, and that the limit of error allowed is 2½%, any mistake beyond that amount being made good to the successful bidder.

THE AMSDEN FURNITURE FACTORY, at Penacook, N. H., will be sold at auction Oct. 30, unless sold at private sale before Oct. 10. The plant includes a five-story factory, 84×200 ft., equipped with modern machinery, with six large dry-houses, a 200-HP. water-wheel, and a nearly new steam plant; dam on the Contoocook River, 13 acres of land, etc. Address Charles H. Amsden, Naval Office, Custom House, Boston, Mass., or John C. Pearson, Assignee, Penacook, N. H.

THE RAMAPO IRON WORKS, of Hillburn, N. Y., is building 30 flat cars and 10 box cars, all of 20 tons capacity, for the Jamaica Ry. (West Indies). They are of substantial construction, with six longitudinal sills, and are carried on steel diamond trucks, having transoms of two I-beams and channel iron spring planks, with one double-coil spring at each end. The cars are equipped with the Gould coupler, Westinghouse air-brake and National hollow brakebeam. The frog and switch shops are busy, and the work on hand includes some frogs and switches of 100-lb. rails for the New York, New Haven & Hartford R. R. The switchstand shop is turning out the standard make of the Snow upright automatic switchstand and the pony horizontal switchstand. The foundry is at work on ordinary brakeshoes, the Ross-Meehan brakeshoe, grate bars, axle boxes and general castings. A traveling crane for loading heavy material on cars is being erected. The business outlook is promising, and the company has more work on hand now than at any time during the past two years.

NEW COMPANIES.—Des Moines Heating Co., Des Moines, Ia.; $100,000; M. P. Turner, J. S. Polk and G. B. Hipper, all of Des Moines.

Walker Foundry Co., Belleville, Ont.; $20,000.

R. D. Hubbard Milling Co., Mankato, Minn.; $300,000.

Park Falls Paper Co., Meenah, Wis.; $80,000; C. W. Howard, Henry Sherry.

Victor Mfg. Co., Greers, Ga.; $50,000; Pres., W. M. Burgess; Secy., Frank Burger.

Colville Rolling Mills Co., Colville, Wash.; $500,000; John Hanly, D. S. Wisner, John B. Slater.

Acme Coupler Co., St. Louis, Mo.; $5,000; J. G. Choteau, J. B. Dockery and Louis Hinsman, of St. Louis.

Dake Engine Co., Grand Haven, Mich.; $60,000; Geo. R. Wyman, W. P. Wyman, J. P. Armstead and others.

American Track Joint Co., Little Rock, Ark.; $250,000; Geo. H. Williams, Wm. Cravens and P. J. MacNamara.

Streator Paving Brick Co., Streator, Ill.; $50,000; Ralph Plumb, F. Plumb and George Goulding, of Streator.

Standard Elevator Co., St. Louis, Mo.; $75,000; E. L. Buschman, A. N. Buschman and Wm. Hoffman, of St. Louis.

Hamilton Brass Works & Faucet Co., Hamilton, O.; $15,000; Paul Trick, Martin Mason and others, of Hamilton.

Bright Star Foundry Co., Saginaw, Mich.; $7,500; Joseph Wachalac, Frank Statara, Alexander Hurdlun, of Saginaw.

Hygeia Ice Mfg. Co., Philadelphia, Pa.; $100,000; John Mundell, M. J. Hayes, John F. Harper and others, of Philadelphia.

Cortlandt Cart & Carriage Mfg. Co., Sidney, N. Y.; $26,000; L. I. Hatfield, T. O. Wheeler, and C. R. Burdick, of Sidney.

Dwyer Motor Water Co., Portland, Me.; $100,000; Pres., George M. Hewitt, Theodore H. Leete, both of Springfield, Mass.

Mesa Land & Development Co., Denver, Colo.; $700,000; E. A. Clifford, P. W. Porter, J. M. Baxter and others, of Denver.

Dunreath Quarry Co., Des Moines, Ia.; $100,000; G. M. Dunreath, G. H. Huttenlocheo, S. C. Slack and others, of Des Moines.

George J. Fritz Foundry & Machine Co., St. Louis, Mo.; $35,000; M. Fritz, E. H. Fritz and Martha M. Kalbfleisch, of St. Louis.

Durham House Drainage Co., New York, N. Y.; $10,000; Henry M. Durham, Herman Meyer and Stephen S. Newton, of New York.

Standard Telephone Co., Waukon, Pa.; $25,000; Pres., G. N. Stevens; Vice-Pres., Herman Boecher; Secy., J. J. Dunleavy, of Waukon, Ia.

Alta Planing Mill Co., Los Angeles, Cal.; $25,000, all paid in; W. S. Arnold, John Robman, Thomas Hughes, and others, of Los Angeles.

Bay State Gold Mining & Milling Co., Denver, Colo.; to operate in El Paso county; $1,250,000; W. R. Latta, R. R. Latta and R. C. Green.

Barber Asphalt Paving Co., Detroit, Mich.; $5,000,000; A. L. Barber, John J. Albright, Joseph J. Albright, and others, of Washington, D. C.

Live Yankee Gravel Mining Co., Graniteville, Nevada county, Cal.; $200,000; W. Mobley, North Bloomfield; D. King and others, of Graniteville.

Insley Mining, Milling & Tunnel Co., Denver, Colo.; to operate in Salt Lake county, Utah; $1,000,000; M. H. Insley, A. J. Smith, and J. W. Randall.

Black Bear Mining Co., Portland, Me.; $100,000, with $600 paid in; Pres., Geo. H. Meeder, of Boston, Mass.; Treas., E. F. Billings, of Newton, Mass.

Newport Grain & Milling Co., Newport, Ark.; $100,000; Pres., George W. Decker; Vice-Pres., J. W. Grubbs; Secy., A. G. Anderson, of Newport.

Granite State Mica Co., Portland, Me.; $300,000, with $30 paid in; Pres., Frank E. Hawler, of Portland; Secy., M. Curtis Fletcher, of Providence, R. I.

Big Stone Gap Iron Co., Louisville, Ky.; to develop coal and iron mines, etc.; $150,000; Charles T. Ballard, J. W. Gaulbert, S. Zorn and others, of Louisville.

The M. E. Kanaly Co., Cambridge, Mass.; to manufacture car door hinges, etc.; $6,000; Pres., Jas. G. Hickey; Treas., Morris E. Kanaly, both of Cambridge, Mass.

New York Fare Register & Supply Co., New York, N. Y.; $50,000; Andrew Hogg and James Brady, of Brooklyn, N. Y., and Wm. W. Jewett, of New Brighton, S. I., N. Y.

Niclaum Water-Tube Boiler Co., Camden, N. J.; $200,000, with $1,000 paid in; Frank T. Patterson and Wm. T. Tiers, of Philadelphia, and Harry Taylor, of Woodbury, N. J.

Pancoast Car & Mfg. Co., Philadelphia, Pa.; $500,000, with $10,000 paid in; Richd. M. Pancoast, Camden, N. J.; Jas. D. Wilson, A. Judson Griffiths and Jos. C. Henvis, of Philadelphia, Pa.

Sutherland Brake Co., Boston, Mass.; to manufacture brakes and wagons of all kinds; $500,000, with $200,000 paid in; S. F. Sutherland, A. H. Gills and F. W. Keogman, of Boston, and A. M. Gardner, of Newton.

James D. Gray Steam Engine & Motor Co., Baltimore, Md.; to manufacture steam engines, electric motors, etc.; $1,000,000, with $50 paid in; P. N. Benson, R. B. W Walling, D. D. Bulman and others, of Baltimore.

Knowlton Packing Co., Portland, Me.; to manufacture rubber goods and engineer supplies; $10,000, with $75 paid in; Pres., Geo. W. Knowlton, of West Medford, Mass.; Treas., Edward R. Metcalf, of Ardmore, Pa.

Canca Valley Development Co., San Francisco, Cal.; to build plants for water-works, gas, and electricity; $1,000,000, with $510,000 paid in; Carl W. Elfuing, Victor F. Seawell, Arthur Elliott, and others, of San Francisco.

Peerless Covering Co., Camden, N. J.; to manufacture a covering for steam heating, water and other pipes, etc.; $10,000, with $1,000 paid in; Jno. T. Woodhull and Thomas B. Hall, of Camden, and C. Rodney May, of Gloucester City, N. J.

The Filter Company General, Camden, N. J.; to buy and sell the Pasteur water filter; $30,000, with $2,050 paid in; H. W. Coleman, 917 Walnut St., Philadelphia; T. C. Johnston, 916 Spruce St., Philadelphia, and J. F. Simpson, Vineland, N. J.

SOME EXPLANATION NEEDED.

Grand Junction, Colo., Sept. 27, 1895.
Engineering News Publishing Co.,
New York City.

Gentlemen: . . . Except our local papers, yours is the only publication authorized to print our water-works advertisement or the notice of postponement of date. I enclose a letter that I have received requesting this privilege. . . .

Yours truly,
F. W. Cobb, City Clerk.

(Strange to relate, this advertisement was printed in the advertising columns of a contemporary July 20 to Sept. 28.—Ed.)

War Department,
Washington, D. C., Sept. 5, 1895.
Engineering News Publishing Co.,
New York City.

Gentlemen: It appears from the records that your paper has published more War Department advertisements than any other journal in the past year.

Yours truly,
John Tweedale, Chief Clerk.

(The words "has published" in the above letter should read "has been directed to publish at regular rates." Engineerings News has not printed so many of these advertisements as have been published elsewhere, but we are glad to learn that we have been paid for printing more than any other paper.—Ed.)

RECENT LETTERS.

We continue to receive letters from subscribers and others showing that the Construction News department of Engineering News is being more and more appreciated, and that those engineers and city officials who advertise their work in this paper find this the most efficient as well as the most economical method of bringing proposed work to the attention of desired parties.

The following extracts are from letters which have recently been received:

AN INTERESTING DEPARTMENT.

"I enclose several news items for your Construction News columns, which I find a growing and very interesting addition to your journal."

WILL TRY TO DO BETTER.

"I regret that I did not send you earlier information, as the newspaper reports (your only available source of information) were incorrect, but I will try to send you early notice hereafter of all our proposed work."

MORE THAN 100 INQUIRIES.

"We received something over 100 inquiries in reply to our advertisement in Engineering News."

CAUSES LIVELY COMPETITION.

"The board was very much pleased with the result of our letting, and attributed the lively competition chiefly to the advertisement published in your largely-circulated paper."

CAUSES TOO MUCH COMPETITION.

"I enclose a notice of letting for building a short extension of our railway. We should have advertised this work in Engineering News, but we did not care to be worried by possibly some 200 contractors writing for specifications and expecting replies. I have been a subscriber to the News off and on for 20 years."

IT ALWAYS PAYS.

"You will find enclosed a schedule of the bids received for our water-works. The much-to-be-desired competition was secured. The committee admits that it pays to advertise, and is well pleased with the result of its advertisement in Engineering News."

FAR BEYOND ANTICIPATION.

Warren, Ill., Sept. 5, 1895.
Engineering News Publishing Co.,
New York City.

Gentlemen: Enclosed find report of water-works letting. We were well pleased with our advertisement in Engineering News. I received over 40 applications for specifications, which was far beyond my anticipation for a job of only $7,800.

Yours truly,
Preston T. Hicks,
City Engineer.

GIVE CREDIT.

We ask our readers to state whenever writing in regard to a news item or a proposal advertisement in our columns that the notice was seen in Engineering News, which prints a much larger number of relinble news items and is much more extensively read by engineers and contractors than any other paper in America.

The Circulation of Engineering News among Prominent Contractors and Contractors' Supply Men Probably Exceeds that of Any Other Five Papers in America.
ADVERTISE YOUR WORK WHERE IT IS GIVEN THE GREATEST POSSIBLE PUBLICITY.